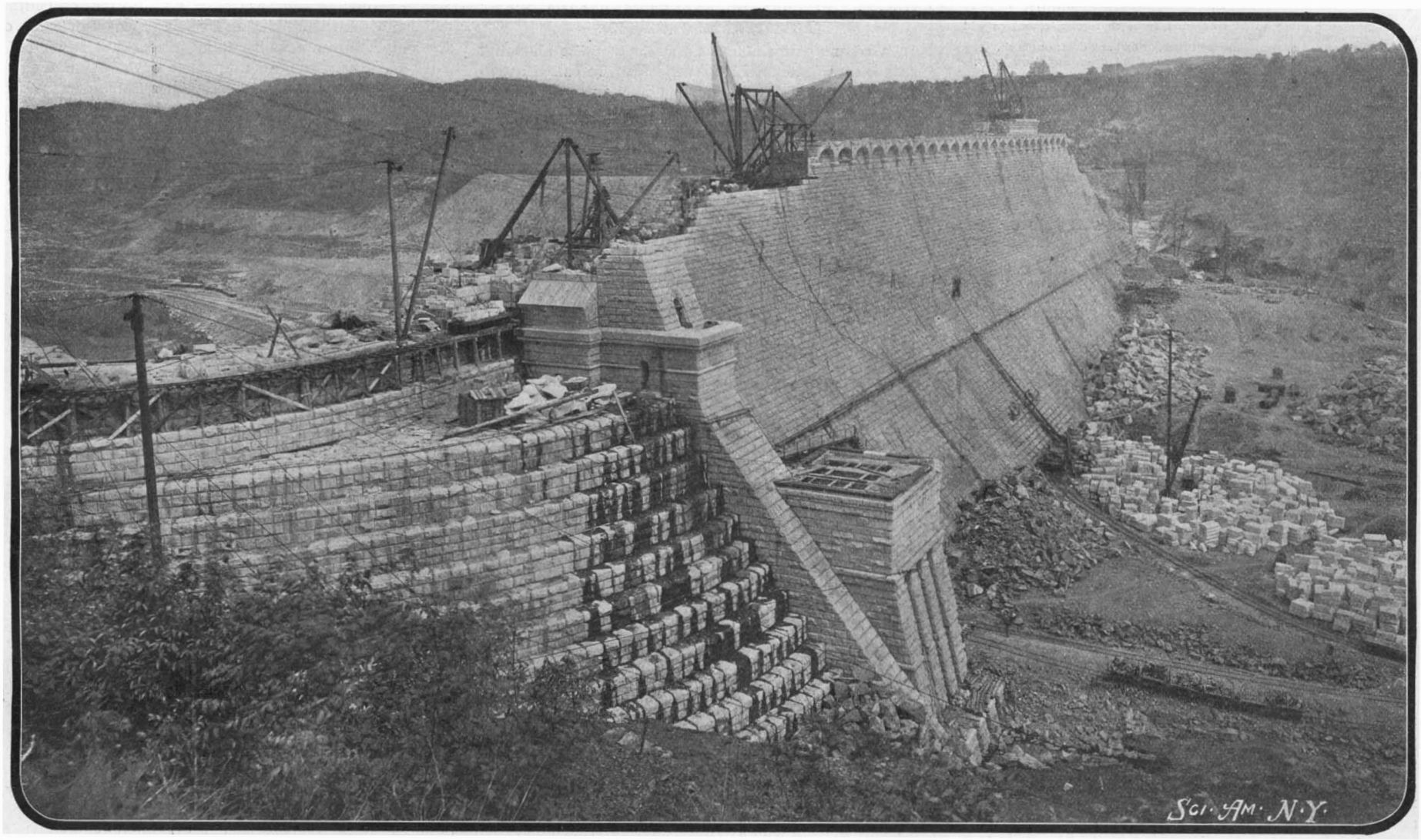
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1903, by Munn & Co.]

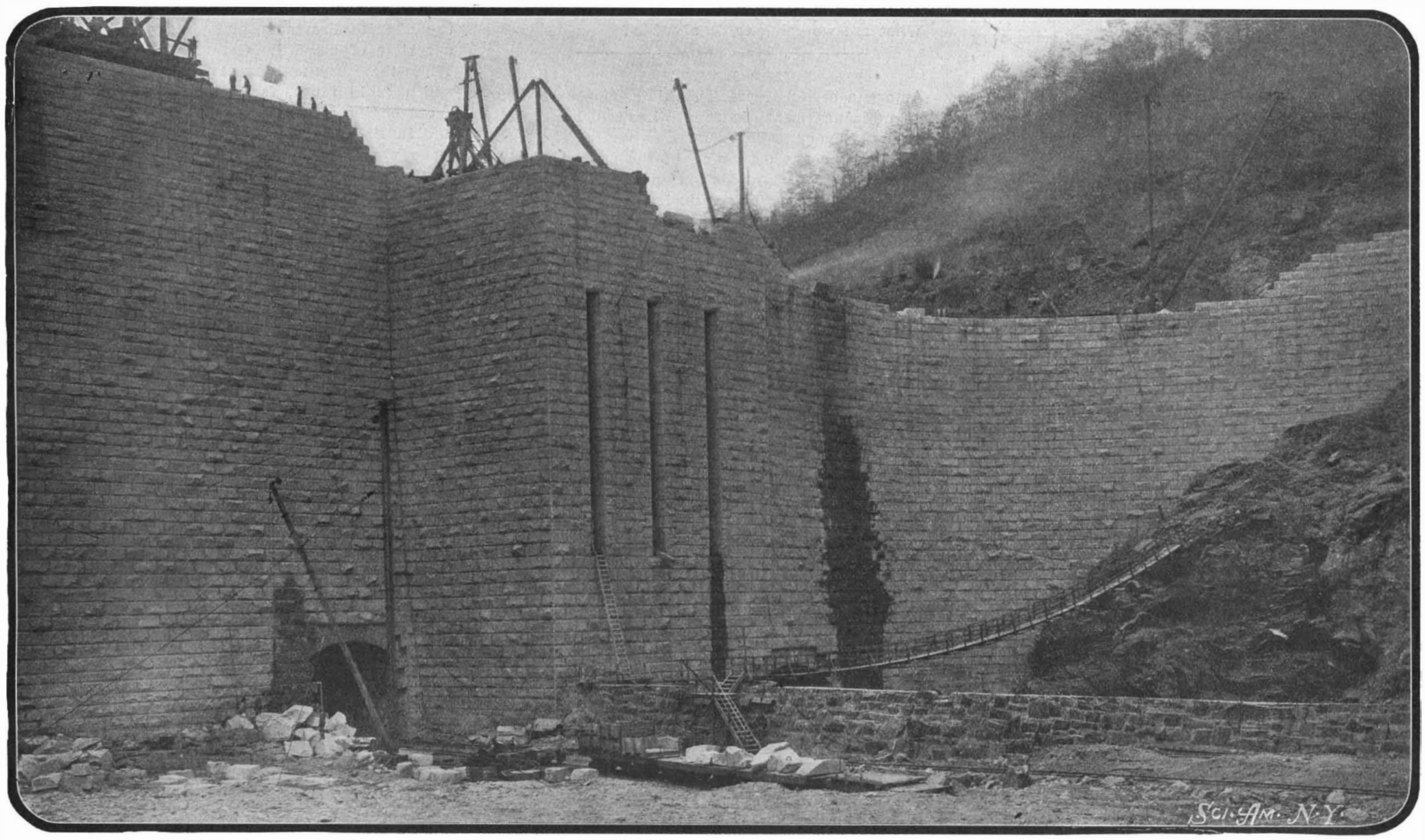
Vol. LXXXVIII.—No. 22. ESTABLISHED 1845.

NEW YORK, MAY 30, 1903.

[8 CENTS A COPY $3.00 A YEAR.



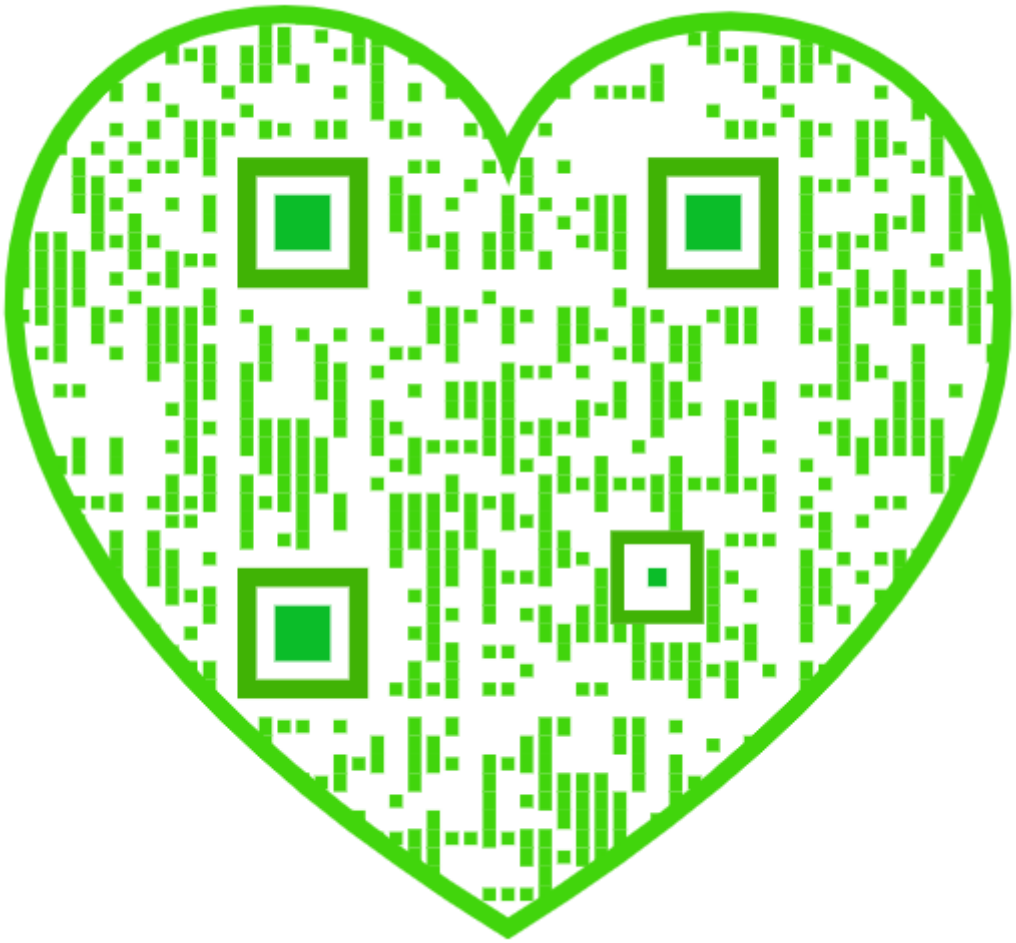
The Masonry Dam, Showing Spillway and Sluice Gates at the Left, and the Incompleted 600 Feet in the Distance.



Upstream Side of Northern End Masonry Dam, Showing Curved Spillway.

THE GREAT CORNELL DAM—FULL HEIGHT, FOUNDATION TO CREST, 300 FEET.—[See page 411.]

© 1903 SCIENTIFIC AMERICAN, INC.



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MAY 30, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE WAR DEPARTMENT AND NEW YORK CITY DOCKS.

It was a far-sighted and, as events have proved, a pre-eminently successful policy to place the supervision and protection of our natural waterways and harbors in the hands of the War Department. Before a bridge can be thrown across any navigable river, estuary, or strait, before any piers can be run out into a harbor beyond certain bulkhead lines that have been laid down, it is necessary to obtain the permission of the War Department. In safeguarding the interests of river traffic, so far as it is affected by the erection of bridges, it has been the object of the War Department to see that no supporting piers are built in midstream that will materially interfere with navigation, and that bridges are either built at an elevation which will allow shipping to pass without hindrance beneath them, or that they are provided with drawbridges of sufficient span to allow shipping to pass through without danger of collision. So also with regard to harbor piers and bulkheads, the War Department has exercised a jealous care that certain lines which they have drawn as marking the limits of the harbors are not encroached upon by docks and landing piers. Had it not been for the professional fidelity with which our military officers have performed their duties, incalculable injury would have been wrought to the shipping interests of this country, both inland, river, and deep sea, by the obstruction of waterways and by destructive encroachments upon the deep-water area of our harbors. At the same time, it has occasionally happened that the War Department has allowed its zeal to get the better of its discretion; for it cannot but happen that the best of principles may, at times, be capable of modification to meet some very special case. We think that such an instance may be found in the present ground of contention between the Mayor of this city and the War Department on the question as to whether an important set of piers which are to be built on the North River, southward from West Twenty-third Street, shall be extended beyond the government bulkhead line.

Time was when a pier with a length of 500 or 600 feet was fully adequate to accommodate the longest transatlantic liners. The last important set of piers completed a few years ago on the North River have a maximum length of 800 feet, this being at that time amply sufficient to accommodate such vessels as the "Oceanic" and "Cedric"; but the fact that the Cunard Company is now contemplating the construction of two vessels which will be not less than 750 feet, and may be 800 feet or more in length, proves that the time has come for 1,000-foot docks. The city has requested the War Department to allow an extension of the pierhead line between West Twenty-third Street and Bloomfield Street, 200 feet further into the North River. The application was made by the Dock Commissioners last summer; but the Board of Army Engineers turned in an adverse report to the Secretary of War. The Mayor of this city and the commissioners have been endeavoring to secure a revision of this report, and we sincerely hope that the War Department may be able to look at the matter from the city's standpoint. The objection to the proposed extension is that it will narrow the width of the North River channel; but even if the extension were granted, the channel would still be 2,600 feet in width, which is amply sufficient for a twin-screw vessel to maneuver in and properly make and leave her dock. As a matter of fact, the War Department, to be consistent with itself in the matter of the New York Harbor improvements, should not hesitate to allow this extension; it is already engaged in dredging 40-foot channels through the lower harbor; and vessels of a size that would call for a 40-foot depth of channel will, of necessity, run to 800 or even 900 feet in length. In a letter on the subject written by Vernon H. Brown, one of the veteran transatlantic steamship men of this city, it is pointed out that "adequate piers are as essential to commerce as adequate channels and waterways;" and that all the expense which the government has entered upon in deepening the channels, in response to a strong and popular demand, may be nullified if the steamships for which such channels are constructed cannot be docked after entering port. In conclusion, we repeat that while the jealous care with which the various boards of engineers of the army have safeguarded our harbors and waterways cannot be too highly commended, we think the present is one of those rare cases in which it would be expedient to observe rather the spirit than the strict letter of the law.

RAILWAY HORRORS VS. THE "HORRORS OF WAR." AN APPALLING RECORD.

In a recent editorial on the subject of the alarming increase of accidents on our railroads, we called attention to the fact that the railroad companies seemed to place a very cheap estimate upon life, as evidenced by the fact that no special measures were being taken to check the rapid growth of fatalities among railroad passengers and employés. We have before us a government publication whose figures present incontestable evidence that the charge of negligence is well founded. According to Accident Bulletin No. 6, published by the Interstate Commerce Commission, the number of passengers killed in train accidents during the months of October, November, and December, 1902, was 266, and of injured, 2,788. Accidents of other kinds, including those sustained by employés while at work and passengers getting on and off cars, etc., bring the total number of casualties up to 12,811. Of these 938 were killed and 11,873 injured; from which we see that at the close of last year our railroads were killing people at the rate of 3,752 per year, and disabling them at the rate of 47,492, a rate of 51,244 deaths and injuries in a single twelve months. Now, these figures are surely sufficiently shocking in themselves; but we can better appreciate their meaning if we compare them with the casualties in some specified instance of the universally-admitted "horrors of war." During the whole of the Boer war, which lasted about three years, the total number of casualties (killed, wounded, died of disease, and invalided home) in the British army was 27,732, of whom 5,727 were killed in action. The Boer losses, if we exclude the number of prisoners taken, were not so numerous as those of the British; but even if we allow that they were approximately equal, we find that the whole number of casualties of British and Boers, throughout the three years, was only about equal to the total number of railroad casualties in the United States, supposing, that is, that the rate shown in the last three months of last year were to prevail for the whole year. Judging from the daily record of accidents during the first three months of 1903, this rate has not only been sustained, but has greatly increased.

What are we going to do about it?

BOILER RIVET HEADS.

Among a series of practical hints on the construction and management of steam boilers that has recently appeared in our esteemed contemporary The Locomotive, we note a discussion of the subject of rivet heads, which is illustrated by cuts of some typical defective rivet heads. These illustrations of themselves are sufficient to prove the necessity for a word of instruction and caution on this most important feature of boiler, tank, bridge, and other kindred work. The specimens presented, which we presume were taken from a steam boiler, show very shallow heads with thin feather edges. They are deficient in strength for any kind of duty, and they would be especially dangerous if they should lie on the furnace side of the plate, where they would be liable to burn off, or to be so impaired by exposure to the furnace heat that leakage and corrosion would probably take place. Although boiler rivets are subject chiefly to shearing stress, there is also a tensile stress in the direction of the axis of the rivet, which acts directly on the rivet head with a tendency to shear it off. Hence the importance of giving such a depth to the head that there shall be sufficient sectional area to prevent longitudinal shearing, and hold the plates in steam-tight contact. In much of the current boiler work the depth is not nearly as great as the heavy duty that falls upon the rivet calls for. This is true in a measure of all riveting, whether it be in tank work, bridge work, or the riveted column and girder work that enters so largely into modern skeleton steel buildings. But in boiler work, as our contemporary points out, it is particularly desirable, because of the complexity of the stresses that occur, that the rivet should be properly proportioned in all of its parts. If it were perfectly certain that the total shearing stress occurring along a certain line of rivets were equally divided among them, we could determine exactly what strain would come upon each individual rivet; but faults of workmanship, and other stresses than those due to the direct pressure of the steam in the boiler, may cause certain rivets to be strained far more heavily than others. Although we are accustomed to provide factors of safety by placing the working stress which a rivet is designed to carry greatly below the breaking strength of the rivet itself, still it is necessary that every rivet should be perfectly proportioned if we are to get the full benefit of this factor of safety, as allowed. The ideal rivets are those which have the same strength in the heads at both ends, and it is customary to consider them satisfactory when the two heads contain an equal amount of stock and are so shaped as to give a proper bearing against the plates, and a satisfactory strength of body. Since, in driving a rivet, some of the material is used in filling up the hole, which is usually 1-16 of an inch greater in diameter than the rivet, an extra length of shank must be allowed for this purpose. This will vary, of course, with the diameter of the rivet and the thickness of the plates through which it is driven; but under ordinary circumstances, an allowance of ⅛ of an inch in length of the shank will provide sufficient extra material for filling the hole. The chief allowance that must be made is, of course, that for the stock which is necessary for forming up a rivet head; and to make sure of having sufficient steel, it is necessary to allow a length of shank whose volume is equal to the volume of the cone head that is in the rivet as it comes from the maker. On a one-inch rivet a good average proportion would be a diameter of 1¾ inches at the base of the head, 15-16 at the top of it, and a depth of ⅞ of an inch. For such proportions it will be found that the extra length of shank necessary to form up a good rivet head must be 1.63 times as long as the diameter of the rivet.

AN AMERICAN OFFICER'S VIEW OF GERMAN INDUSTRIES.

Lieut. Godfrey L. Carden, R. C. S., who was detailed by the government for duty at the World's Fair, St. Louis, has recently returned to the United States after an eight months' period spent among the iron and steel and machinery establishments of Europe. Lieut. Carden went from St. Louis direct to the Krupp works, at Essen, Germany, in July last, and he has been actively employed in the interests of the Machinery Department of the St. Louis Exposition ever since that date.

In a little more than three months' time Lieut. Carden visited more than three hundred of the iron and steel and machinery works of Germany, and his investigations carried him as far north as Stockholm, Sweden, as far south as Legnano, Italy, and included in addition to Sweden, Germany, and Italy, the countries of Switzerland, Belgium, France, and the United Kingdom. In speaking of the conditions in Germany, Lieut. Carden said: "Of all the countries of Europe, Germany has probably made greater advances than any other in the last ten years. The display at the Düsseldorf Exposition was a rude awakening to many of the immense importance of the establishments of the Rhenish Provinces, and plainly indicated that in a matter of sizes the Germans hesitate at nothing. While there was nothing at the Düsseldorf Exposition which could touch, for example, some of the high-speed engine work in the large sizes which one will find in England, still the surprise was that the Germans were so far advanced. This statement applies to the great run of the German establishments, for plants like Krupp, the Bochum houses, Haniel and Lueg, and some others which could be mentioned, have long held a place in the very first rank.

"I doubt if anywhere in the world one will find so many up-to-date plants as exist now in the Rhenish Provinces; and when I say up-to-date I refer to the systems of installation and the general internal facilities. The sanitary arrangements in the various German shops are superb, and in the matter of economics they can teach us on this side of the water very much indeed in fact, I was almost going to say they can teach us everything.

"Ten years ago one might have traveled up the Rhine, and in practically every shop of any importance one would have found English tools; to-day all this is changed. The small shops of ten years ago have given way to pretentious buildings, arranged and equipped in the most modern fashion; but instead of the English tools of a decade past one now finds, for all general work, German tools, with, however, this addition, that for high-grade work requiring great precision and excellence there is also to be found in nearly all the leading shops a group of American tools—a silent tribute to the remarkable position held in the world to-day by the American machine tool's work.

"After I had visited the first one hundred and fifty iron and steel and machinery houses, I reported that I found but two establishments where English was not spoken. As a matter of fact, the German director almost without exception has a very full knowledge of the English language. I have sat at boards of directors' meetings where no less than seven directors were present, and every German director speaking English almost faultlessly.

"Just now the conditions among the iron and steel

© 1903 SCIENTIFIC AMERICAN, INC.

and machinery houses of Germany are anything but good, but they are better during the past two and three months than they were last autumn. If the coefficient 5 represent normal conditions, the coefficient 1½ would represent conditions late last year. At the present time the conditions are represented by the figure 2¼. In a number of German establishments practically the whole output just now is in filling American orders—orders which are the result of inability on this side of the water to meet the demand. These orders are largely in the nature of calls for structural steel and allied work, and at one plant which I visited there was an order on hand from America for 20,000 tons of steel rails. The prosperous conditions in the United States have also been felt in the German machine tool trade, and a number of respectable orders for the best grade of German tools to fill demands on this side were in evidence when I was in Berlin.

"On the other hand, I visited a number of German establishments which ordinarily would employ 1,500 to 1,800 men, and not a wheel was turning over in the shop; the cause was—no orders. The depression was so great some five months ago that in many sections of Germany the word 'distressing' best expressed it. But now the outlook is brighter, and with the amalgamation of many interests there is every prospect of the German trade regaining ground. I found considerable apprehension expressed in many quarters regarding the possibly far-reaching influences of American trusts, but I am inclined to think that this feeling of apprehension is disappearing; in fact, some German manufacturers were inclined to ascribe their good fortune in receiving American orders to the very existence of the trusts.

"The electrical business in Germany has been even poorer of late than the iron and steel trade, and the stability of some establishments has been threatened. The amalgamation of many of the important plants has saved a number of these houses.

"Despite the depressing conditions which existed, I failed to hear any talk of strikes or of marked discontent. This is doubtless due to the national spirit, which again is the outcome of military training. On the other hand, there is not apparent among the German workmen the ambition so familiar to us in this country. I am reminded of the American manager whose services had been secured for a German establishment, and who finding a number of orders on hand, endeavored to dispose of these orders by encouraging the workmen to work harder. Inasmuch as the employés were paid on the per cent basis, the manager felt that he was quite in order in urging extra work. He therefore called the foremen together, and endeavored to impress upon them the necessity for greater effort. On the day following, the manager found that the volume of output was exactly the same as the day before. He made a second appeal, but still the volume of output remained the same as before. In his anxiety to dispose of the orders the manager succeeded in having an increased per cent allowance awarded, but despite this concession the volume of output remained as previously. The manager then tried a new tack. He cut the per cent, and immediately the volume of output rose to a point where the workmen could receive the same income as they had formerly derived.

"There is a tremendous latent force in Germany which cannot fail to impress the American who visits the German shops. It is a force which, if thoroughly aroused, will give us a tremendous struggle in the commercial world. But of the two classes, the German workman is doubtless the happier, and in the great Essen district, where the wise administration of the Krupp factory prevails, one finds probably the most ideal and contented community of all Europe. Such a thing as a strike is unknown where the Krupp influence exists."

THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH.D.

At 10 o'clock on the morning of June 22 the sun enters the sign of Cancer, and in the phrase of the almanacs, "Summer commences." In other words, the sun reaches his greatest north declination, and consequently remains above the horizon for a longer time than on any other day of the year.

In spite of the lateness of sunset, the twilight will be pretty well over by 9 o'clock—at least in the latitude of New York—so that we need not change our hour of observation.

At 9 o'clock on the evening of June 15 Arcturus, the brightest star in sight, is nearly overhead, being about 20 deg. south of the zenith. Half way down from him toward the horizon, and rather to the westward, is Spica. Mars, which still vies with Arcturus in brightness, lies farther west in the same direction, but farther on and lower down, we reach first Regulus and the other stars of Leo, and then Castor and Pollux, the last just ready to set.

Between Leo and the Pole is Ursa Major, which covers an immense amount of sky, the familiar Dipper being less than half of the constellation.

In the south, below Spica, we can see part of the southern constellation Centaurus, while in the southeast appears the more familiar form of Scorpio, with the fiery Antares blazing at its heart, and its long curving tail sweeping down to the horizon.

The bright star in the Milky Way, almost due east, is Altair in Aquila, while the still brighter one higher up on the left is Vega, which belongs to the constellation Lyra. Below Lyra is Cygnus, marked by a cross of bright stars whose upright lies along the middle of the Milky Way. Between Vega and Arcturus lie the large, but dull expanse of Hercules and the pretty semicircle of Corona. The large space between these and Scorpio is filled by Ophiuchus and Serpens. The outlines of the serpent and of the giant who carries him are too much confused to be well traced without the aid of a star-map and celestial globe.

Of the circumpolar constellation, Cassiopeia is below the pole, almost out of sight, Cepheus to the east of it, and Ursa Minor and Draco above.

Now that Lyra is once more conveniently placed for observation, it is a good time to refer to a very interesting piece of work that appeared last autumn; namely, the determination of the parallax and distance of the famous ring nebula in this constellation.

This remarkable object may easily be found by those who have telescopes of moderate size, as it lies almost on the line joining Beta and Gamma Lyræ—the two small stars which lie about one-quarter of the way from Vega toward Altair. In a small telescope it appears simply as a faint oval ring of light, greenish in hue, with an apparent diameter nearly twice as great as that of Jupiter. With great telescopes many finer details are visible, and even more is shown by photography, including a star-like condensation in the center which is only visible with the most powerful instruments.

A number of photographs of this nebula, taken at the observatory of the University of Minnesota, have been measured and reduced by an American student in Germany. They afford conclusive evidence that the central star of the nebula has a sensible parallax, amounting to about 1-10 of a second of arc.

As this central star is exactly in the center of the ring, and shows the same gaseous spectrum as the rest of the nebula, there can be no doubt that it is a part of it.

We are consequently able to calculate the real distance and size of the nebula. The former appears to be about two million times that of the sun, so that the light of the nebula takes over thirty years to reach us. It is, however, a near neighbor of ours as stellar distances go, being only three or four times as far away as Sirius or Procyon, and nearer than Capella or Vega—as far as the best observations show. The apparent diameter of the nebula, measured along the longer axis of the oval, is 80 sec., which corresponds to a real diameter 800 times the earth's distance from the sun. This is 13 times the diameter of the orbit of Neptune, so that the whole solar system is a small affair alongside of this nebula.

Of the mass and density of the nebula we have as yet no knowledge; nor do we know why it shines. The spectroscope shows that it, like many other nebulæ, is gaseous; that is, the luminous part at least is gaseous, and contains hydrogen, helium, and some unknown gas whose lines are the brightest of all. But why this gas shines, whether because it is hot, or under electrical action, or under other conditions quite different from anything that we are able to produce in our laboratories, no one knows. It is one of the many unsolved problems of astrophysics.

THE PLANETS.

Mercury is evening star until the 3d, when he passes through inferior conjunction, and becomes a morning star. He will not be visible till the last few days of the month, when he is again in elongation. This happens on the 27th, and for some days about that date he rises almost an hour and a half before the sun, so that he should be easily seen.

Venus is evening star, still steadily moving away from the sun and growing brighter. But as she is also moving southward, she becomes somewhat less conspicuous, as the interval between sunset and her own setting decreases from 3¼ hours on the 1st to about 2½ hours on the 31st. At the beginning of the month she is in Gemini, near Castor and Pollux, while at its end she is in Leo, having crossed the whole width of Cancer in the interval.

Throughout the month she can be seen in broad daylight if one knows where to look for her, and there is not the least difficulty in seeing the shadows cast by her light if one admits it through a window into an otherwise dark room.

Mars is in Virgo, and is still a conspicuous feature of the sky, though less than half as bright as he was in April. He is moving eastward among the stars, and decreasing in brightness.

Jupiter is morning star in Aquarius. On the 13th he is in quadrature, and rises a little after midnight, reaching the meridian at 6 A. M.

Saturn is in Capricornus. On the 15th he rises at about 10 P. M. Uranus is in opposition on the 15th, and is just visible to the naked eye on a clear night. He is in Sagittarius in right ascension 17 h. 32 m., and declination 23 deg. 26 min. south. It is difficult to describe his position, as there are no well-known stars near him, but he can be found with the aid of a star-map or identified by his motion, which is in an easterly direction, at the rate of 1 deg. in three weeks.

Neptune is in conjunction with the sun, and is invisible.

THE MOON.

First quarter occurs at 8 A. M. on the 2d, full moon at 10 P. M. on the 9th, last quarter at 2 A. M. on the 18th, and new moon at 1 A. M. on the 25th. The moon is nearest us on the 13th, and farthest away on the 25th.

She is in conjunction with Mars on the evening of the 3d, Uranus on the 10th, Saturn on the 14th, Jupiter on the 17th, Mercury on the 23d, Neptune on the 25th, and Venus on the 28th.

None of these conjunctions are close, that with Mars being the nearest, about 2½ deg.

Cambridge, England.

SCIENCE NOTES.

Monsoon stations are to be established in India for the purpose of taking observations by means of kites and kite balloons. The first station will be in the Himalayas at Simla, 7,000 feet above the level of the sea.

Announcement has been made of the election of Dr. Robert Koch as the foreign associate of the Paris Academy of Sciences, which place was formerly held by Prof. Rudolf Virchow. Dr. S. P. Langley was mentioned for the place, and received six votes.

At a recent meeting of the National Association for the Prevention of Tuberculosis in London, it was announced that Messrs. Wernher, Beit & Co. had made a second gift of twenty thousand pounds sterling to further the work of the association. A like amount, given some time ago with the stipulation that it should be used only so as to be of benefit to the poor of London, has been entirely spent in the erection and partial equipment of a sanitarium with sixty-four beds at Pine Wood, near Wakingham, and this second amount was given in order that the undertaking might be completed.

Mr. Follett Osler, the inventor of the anemometer, recently died at the age of ninety-five. Originally he was interested in the glass-manufacturing industry at Birmingham, where his father carried on the business of glass-toy making. When Mr. Follett Osler succeeded to the business, he devoted his special attention to the making of large glass chandeliers and one of his most notable achievements was the manufacture of the huge glass fountain which was such a feature of the Great Exhibition held in London in 1851. Before that time no articles in glass were produced exceeding 3 feet in height, but he made several glass objects exceeding 20 feet in height. He constructed a magnificent, huge glass sideboard for the Paris Exhibition of 1878, and also manufactured table glass, devoting special care to the purity of color, fine cutting, and engraving. When he retired from the glass industry he devoted his energies to meteorological apparatus, natural philosophy, and mechanics. His first anemometer he devised in 1836, and this was the first instrument constructed for measuring the pressure and registering the direction of the wind. In his contrivance there was a large brass plate 12 inches square, supported upon springs, and this by means of a vane was always maintained at a position at right angles to the direction of the wind. Each gust of wind when it blew upon the plate forced it backward, and the pressure thus exerted was recorded by a pencil upon a sheet of paper stretched upon a drum, driven by clockwork so as to make one complete revolution once in every four hours. The motions of the vane indicating the direction in which the wind was blowing were also simultaneously registered upon the same drum with another pencil, while the amount of the rainfall as recorded by the rain-gage was duly indicated by a third pencil. This anemometer was first set up by Osler upon the roof of the Philosophical Society's building in Birmingham in 1836, and is still in use to-day, rendering valuable service at the Midland Institute Observatory in the same city. For the invention of this instrument Osler was elected a Fellow of the Royal Society of Great Britain. His other most important appliance is that utilized in connection with anthropometry, the branch of this science for which it was specially adapted being the measurement, with minute exactness, of the human head. In this device there is a special clip especially for the cross section of the skull, with a sliding pencil which registers the exact contour of the head and gives measurements in small fractions of millimeters.

© 1903 SCIENTIFIC AMERICAN, INC.

THE IVEL AGRICULTURAL MOTOR.

BY HERBERT C. FYFE.

For some few weeks past there has been at work in England a new portable petrol agricultural motor, the invention of Mr. Dan Albone, of the Ivel Motor Works, Biggleswade, Bedfordshire.

This new motor has been designed and made chiefly for the use of farmers. It is constructed to draw motors, reapers, plows, scuffles, wagons, etc., by attaching these machines to the back of the motor. The connection is formed by taking out the long pole of the mower, etc., and substituting a shorter one, the latter being joined to the motor by a spring coupling. Almost any agricultural machine can be attached to the motor in a few minutes, and apart from working in the fields it can be utilized on the farm for cutting chaff, pulping roots, grinding corn and other operations.

THE IVEL MOTOR LAWN-MOWER.

The petrol motor is an 8 horse power double-cylinder with water circulation. It has electric ignition, one speed forward and reverse, and it is claimed that any ordinarily intelligent farm hand could drive it after a few lessons. The engine is free, and when put in motion a friction clutch is employed to transmit the power through an intermediate shaft to the balance gear shaft of road wheels, by means of patent silent running chains. The wheels have extra wide rims with grips on to prevent them from skidding round. The machine complete weighs 17 hundredweight, 7 pounds, and for traveling on the high-road detachable rubber pads are attached to the rims of the wheels by means of thumb screws. These rubber pads lessen the vibration and enable the motor to run more silently than it would do otherwise.

They are easily fitted or taken off in a very short time. The cost of fuel and necessities in running the new agricultural motor is very small and Mr. Dan Albone claims that it works out considerably less than the cost of horse labor.

During the past autumn the Ivel agricultural motor has been employed in harvesting operations in Bedfordshire, Lincolnshire and other English counties. The motor attached to a Hornsby 6-foot reaper and binder cut heavy crops of wheat and it was found that the cost of fuel worked out at about 8d. an acre and that less time was taken than formerly when horse labor had been employed. Besides this, two horses and a man were dispensed with, for the motor requires only one man to manipulate it.

The Ivel motor also cut a field of barley, and after cutting the crop it drew the loaded wagon from the field. In order also to prove its capabilities Mr. Dan Albone attached a two-furrowed Hornsby plow to the motor and a piece of oat stubble land was plowed. The work was declared by farmers, who witnessed the trials, to be exceedingly well done, the furrows being even and of good depth. Martin's cultivators were also tried attached to the motor and the work in this case was equally well done. The motor plow can easily cut two furrows in one operation, about 20 inches wide and 5 inches deep. There is no doubt that in agricultural operations there is a great future before the mechanically-propelled vehicle. Hitherto in Great Britain the stationary engine has been almost exclusively employed, though in some places traction engines are used to haul plows, mowers, reapers, binders, etc., across the fields. The motor in the field itself running up and down the land is a new departure in England and there is no doubt that such a motor as the Ivel will prove of very great value to the farmer. There is much agricultural depression in Britain, yet it was estimated that last autumn there were more than six and a half million acres of wheat, barley, and oats to be reaped, to say nothing of nearly eight million acres of hay to be cut in England alone.

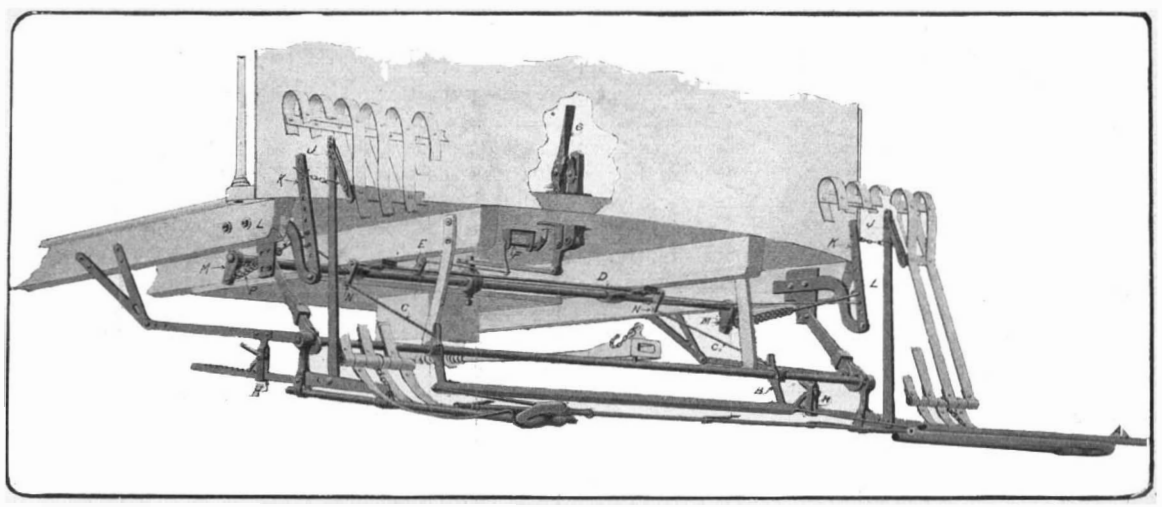
THE IVEL MOTOR-PLOW.

Labor, however, is scarce (due in great part to the South African campaign) and dear and horses are costly, machines which require to be fed and looked after even when the conditions of weather make it impossible to use them either in the fields or about the farm. The motor is a tireless worker, and after a hard day's work in the fields it can be sent up to town at night with loads for the market, returning with household necessaries and all those things necessary for the daily work of the farm.

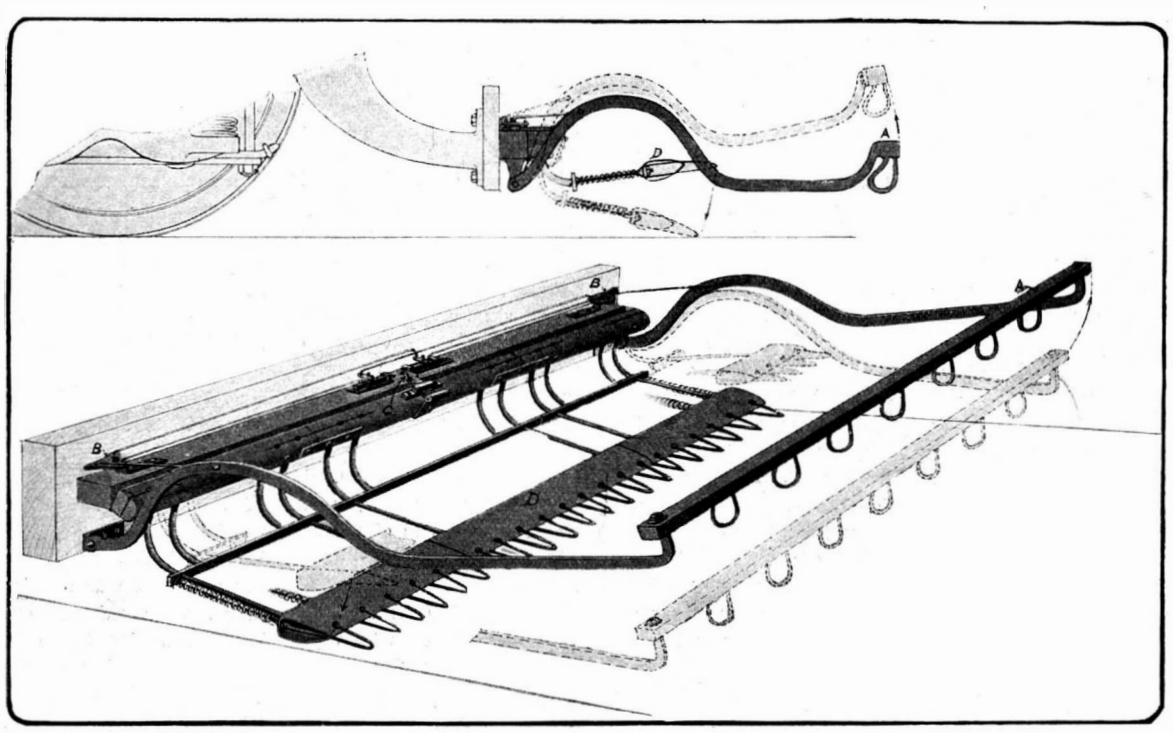
NEW AUTOMATIC FENDER AND WHEEL GUARD.

The fender most commonly used on street railway cars belongs to what is known as the "foot-drop" type, so called because the motorman must operate a foot-pawl in order to drop the fender to the track. In an emergency, however, for example, when a person suddenly appears from behind a car going in the opposite direction, the motorman is very liable to forget the foot-pawl in his efforts to stop the car, and as a result the victim is rolled under the fender and crushed by the wheels. The daily occurrence of such accidents is gradually forcing street railway managers to adopt fenders which will drop automatically. The motorman can then devote his entire attention to the control of the power, brake, sand, and gong.

A fender of the automatic type which is now meeting with great favor is shown in the accompanying illustration, in which the fender strips have been partly broken away to bring out details of construction. This fender may be operated in three different ways; first by the foot-drop, second by what is called the "front receding trip," and third by an entirely new device called the "automatic release." Where objection is raised to the front trip this may be discarded, and only the foot-drop and automatic release used. To operate the foot-drop the pawl *G* is pressed, releasing the bell crank located immediately thereunder and permitting the rockshaft, on which the arms *M* are secured, to rotate. The rocker-arms are connected by the connections *L* to the levers *K*, which in turn are connected by chains to the levers *J* and the fender cushion attached thereto. Operation of the foot-pawl *G* therefore, releases the fender, permitting the cushion to swing forward and the cradle to drop downward by their own weight.



THE WATSON AUTOMATIC DROP CAR FENDER.



AUTOMATIC DROP WHEEL GUARD SHOWING NORMAL AND OPERATING POSITION.

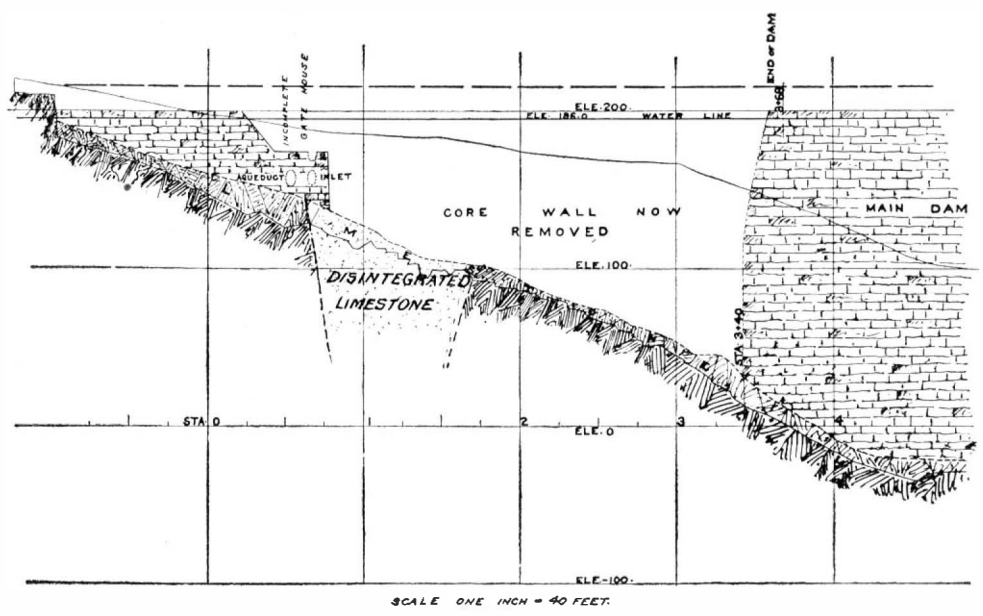
In the front receding trip, the foot pawl is operated as follows: The front trip-bar *A* on striking an obstruction is forced back, swinging the levers *B* on their fulcrum and throwing forward the rocker-arms *N*. The rod *D* on which these rocker-arms are mounted is also provided with an arm *E* connected to a crank *F* whereby the motion of the trip bar *A* is communicated to the foot-pawl *G*. On release of the foot-trip, the action of the fender takes place as stated above.

In winter time, should the trip-bar *A* come in contact with snow drifts, it may be turned up against the back of the fender. When in that position the automatic release comes particularly into use. The weight of a person falling on the cradle causes the fender to drop to the roadbed. By the use of springs in the connections *L* between the fender and the rocker arms *M* the fender is allowed to fall forward slightly under the additional weight on the cradle, and the rocker-arms *N* are pulled forward because of their connection with the levers *K*. The foot-trip *G* is then operated through the rocker-arm *E* and crank *F*, as described above. In order to prevent the fender from falling of its own weight on being jounced up and down over

© 1903 SCIENTIFIC AMERICAN, INC.

an uneven track, the connecting rods from lever *K* are not rigidly secured to the arms *N*, but slide freely therethrough until the springs on the connections *L* have been sufficiently distended to bring the collars on the rods into engagement with the arms *N*. Obviously the collars can be so placed that the crank arms will not be moved until a considerable weight has been imposed upon the fender. When the fender drops, whether automatically or otherwise, it is locked in this position by means of lock bars, which swing backward from the common pivot and are held by pawls *H* engaging ratchet teeth formed on the bars. The fender can be easily attached to a car, two bolts on each outside sill of the car platform being all that are necessary to hold the fender, hangers, and adjustments. It can be compactly folded, and does not interfere with the headlight or offer any obstruction when coupling. The rods each have a direct pull, so that the fender is not liable to get out of order. The cushion front of the fender is made of rubber tubing with a small steel wire cable passing through it, which, together with the telescopic frame, makes a most flexible fender for contact with an obstacle.

The fender is the invention of Mr. W. T. Watson, of Newark, N. J., who has also invented a wheel guard for use on cars not provided with fenders. In our illustration of the wheel guard, the upper view shows the guard in its normal position with the operating position indicated by dotted lines, while the lower view shows the guard dropped and the normal position indicated by dotted lines. The wheel guard is dropped by means of the trip-bar *A* which is raised on coming in contact with a body larger than would pass under the truck pilot board. Through the intermediary of star wheels *B* the motion of the trip-bar is made to release the catch *C*, permitting the guard *D* to drop to the roadbed. The construction of this guard is very ingenious. It comprises a buffer, from which a number of fingers project, the latter being held outward by light coil springs, as shown. In passing over rough pavements, cross tracks, and the like, the fingers play in and out independently. A finger on striking a stone or similar object will be pressed back into the buffer until the latter, owing to its beveled under surface, slides over the obstruction and permits the finger to spring clear of the same. This construction, it will be observed, prevents injury to the parts and at the same time allows the guard to hug the roadbed in order to prevent it from passing over a body. The guard can be readily attached to any pilot board of standard make. It has no connection with any part of the car body and therefore swings around curves with the truck, being held directly over the rails at all times. This feature is particularly important for double-truck cars. The trip-bar *A*, being well in advance of the wheel-bar, when rising over an obstacle gives ample time for the wheel guard to drop. Snow does not interfere with this type of wheel guard because a lifting motion of the trip-bar is necessary to cause the buffer to drop, and in this construction the bar on coming into contact with a drift is forced directly forward, cutting through the snow instead of passing over it.

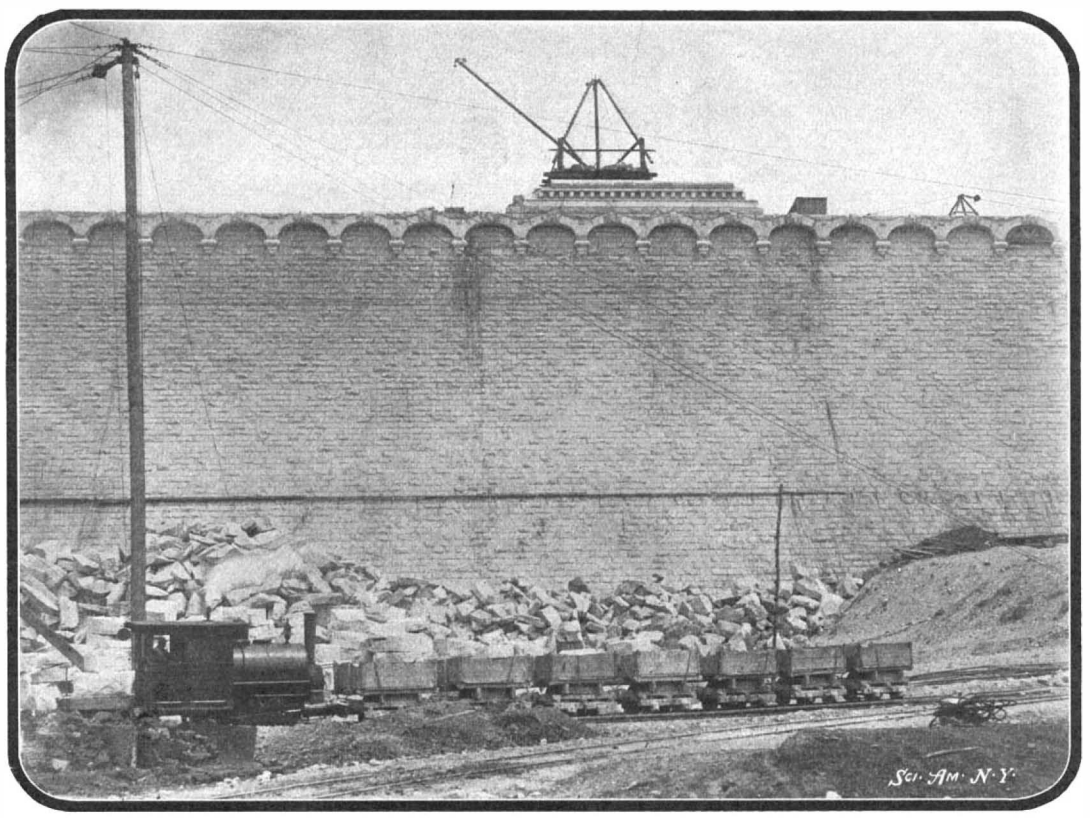


Longitudinal Section on Axis of Dam, Showing Masonry Dam, Part of Core-Wall, and Defective Limestone Foundation.

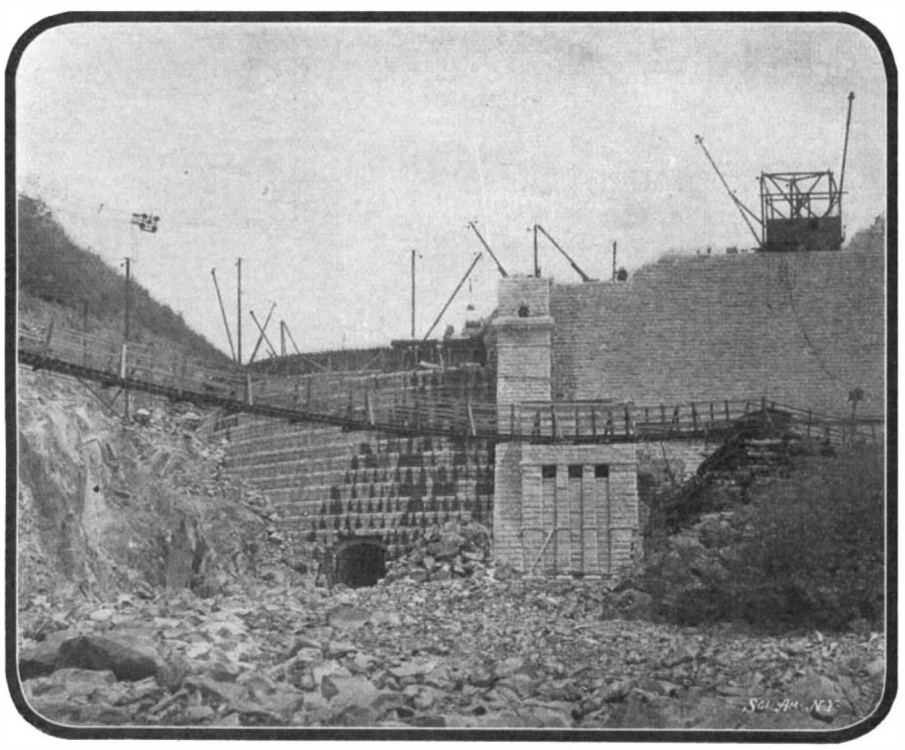
THE PROBLEM OF THE GREAT CROTON DAM—NEW YORK CITY WATER SUPPLY.

The public alarm over the reported defects of the great Cornell Dam, which, when it is completed, will impound an additional 32,000,000,000 gallons of water for the supply of New York city, is perfectly natural and to a certain extent justified. It is natural, for the reason that if the structure after its completion should give way, not only would the additional supply of water be lost, but probably the present Croton Dam behind it, further up the valley, would be swept away in a terrific downward rush of the water, and New York city would be immediately brought face to face with a water famine that would be tragic in its results. Public concern about the dam is justified, moreover, to the extent that the natural foundations below the existing core-wall-and-earth dam have been proved to be exceedingly treacherous, and unless they are improved by carrying down the excavations until they reach a solid, impervious rock, they will constitute a serious menace to the future safety of the whole structure.

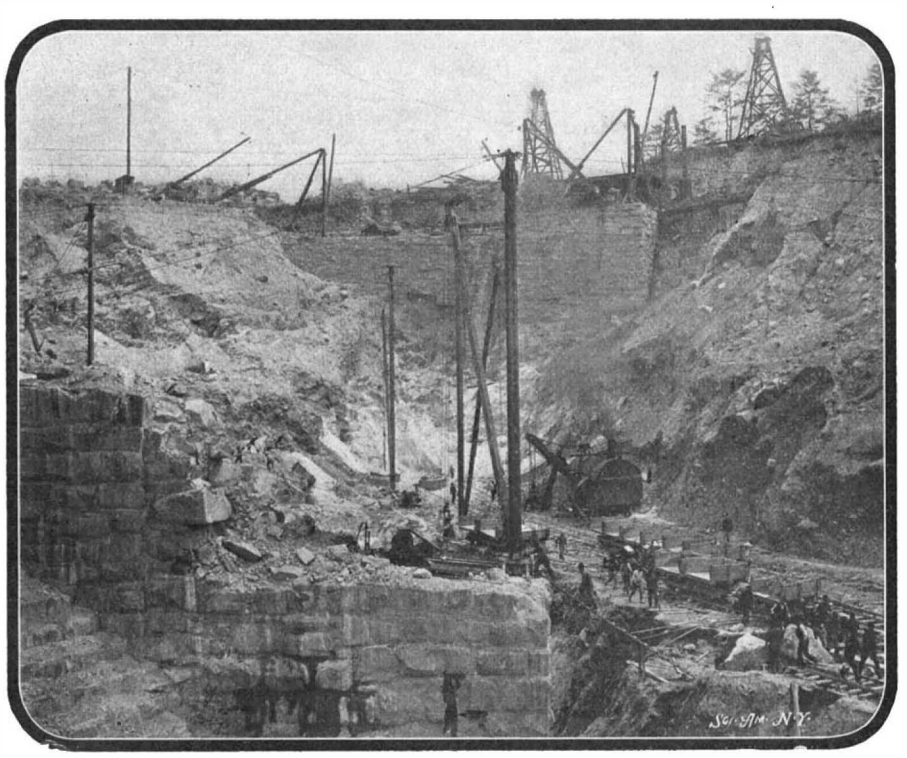
The dam as originally laid out, and now nearly four-fifths completed, consisted of 1,000 feet of masonry spillway, 1,000 feet of masonry dam, and about 600 feet of dam at the southern end of the structure, built on the core-wall-and-earth system. The masonry dam proper consists of an enormous mass of rubble work laid in cement, which is over 200 feet in width at its base and extends for about 300 feet in height from base to crest. In building this portion of the dam a huge trench, extending 160 feet below the bed of the Croton River, was excavated, all the loose, disintegrated rock that was at all pervious



A Portion of the Dam Completed to Its Full Height.



The Northerly End of the Dam, and the Steps of the Spillway.



View of Excavation Below Core-Wall, Showing by Lighter Tint the Defective Rock.

THE GREAT CORNELL DAM.

© 1903 SCIENTIFIC AMERICAN, INC.

to water was carefully removed, the solid bedrock as thus exposed being thoroughly cleaned and washed with pure cement, and the great rubble wall was then built up with extreme care upon the foundation as thus prepared, the blocks of stone of which it is built averaging three feet or more in thickness and weighing several tons apiece. The masonry portion of the dam as thus built up, now practically completed, is a magnificent piece of work, and among the greatest of its kind ever constructed. From motives of economy, the southerly 600 feet of the dam was originally designed to be built with a central core wall founded like the main dam upon rock, and extending to the full height of the dam, with a mass of earth banked up against it on both the up and downstream sides, the earth and embankments being built up in six-inch layers, watered and rolled as they were put down. In this type of dam the central core wall, which in the present case was 18 feet wide at the base and tapered to a width of 6 feet at the top, is supposed to present an absolutely impervious diaphragm to the passage of water, while the mass of earth on both sides of the wall is supposed to give the necessary inertia to resist displacement by the pressure of the impounded water. Smaller dams of this type have been built and have stood successfully for many years; but there is no record of any being built of the great height and importance of the Croton Dam. For this reason, and also because it was considered that the sudden transition from the massive and unyielding masonry dam to the relatively light and thin masonry core wall presented a feature that was constructively undesirable, and for the further reason that serious cracks had already developed in the core wall before there was any water pressure upon it, the present chief engineer of the work recommended that the core wall be removed, and that the southerly 600 feet of the dam be built of masonry to correspond with the existing masonry portion of the structure as above described. An expert commission was appointed to examine and report upon the suggestion, and they unanimously recommended that the change recommended by the commissioners' engineer be carried through. The blasting away of the core wall and the carrying down of the foundations to secure a solid rock bottom has been going on for several months. On laying bare the foundations, it was discovered that for a distance of some 60 or 70 feet the core wall had been built upon a stratum of disintegrated limestone, which was so soft that upon being struck with a pick it crumbled into dust, and under the action of water would run like so much quicksand.

It was the discovery of this stratum which gave rise to the alarmist rumors concerning the insecurity of the whole dam as constructed. As a matter of fact, it was only a portion of the extreme southerly end of the dam, where it is comparatively shallow, that is affected, and it now becomes merely a question of quarrying down and taking out this decomposed limestone until a perfectly solid rock bottom has been reached. Unfortunately, the limestone stratum is approximately vertical, and runs at right angles to the axis of the dam, and hence it may be necessary to go down to an unprecedented depth before the pocket has been cleaned out and it becomes possible to perfectly seal up the foundations at this point. Borings have been carried down some 40 or 50 feet below the present excavation without revealing any improvement in the material. The disintegrated limestone is creamy white in color, and it can be clearly identified by its lighter tint in one of the accompanying illustrations showing the work of excavating as now being carried on at this point. The wall of masonry shown at the further end of this excavation is the gate house known as No. 1. It was built to control the supply of water from the new dam to the old aqueduct, which intersects the dam at this point. This gate house, together with the location of the limestone stratum, the core wall which is now being removed, and the existing masonry dam, are all shown in the accompanying drawing representing a section along the axis of the dam. Last year, at the request of the chief engineer, the Aqueduct Commission invited Prof. Kemp, of Columbia University, and Prof. Stevenson, of New York University, both geologists, to investigate the matter of the foundations, and their findings spoke of the condition of the foundations of gate house No. 1 and of the adjoining portions of the old aqueduct as "deserving very serious consideration." It is more than likely that the gate house and a small portion of the old aqueduct will have to be taken down and reconstructed during the extension of the masonry dam.

These considerations of the faulty character of the rock below the southerly portion of the dam do not imply that there is anything wrong with the foundations below the main dam. But in order to set at rest any doubts on the subject, a series of deep borings is to be made across the valley at the base of the dam, to ascertain, beyond all question, if there are any pockets of permeable material that need to be dealt with. The Aqueduct Commissioners have appointed Prof. Burr, of Columbia University, to advise the Commissioners and consult with their Chief Engineer on the whole subject of the dam foundations; and while it is, of course, deplorable that this much-delayed and urgently-needed public work should be subjected to still further delay, there is at least the satisfaction of knowing that the work as now being carried through will be beyond any suspicion of weakness and will last as long as the hills themselves.

Our various photographs show clearly the present condition of the work, which is so far advanced that it is proposed to commence filling the dam late in the present year. Including the southerly 600 feet, the total amount of masonry in the whole structure will amount to 820,710 cubic yards. Of this total, 687,180 cubic yards have been built in place, leaving 134,530 cubic yards, or less than one-fifth of the work, to be laid before the structure is completed.

Results of the Commercial Vehicle Test.

In the test of commercial self-propelled vehicles, held by the Automobile Club of America on May 20 and 21, eleven delivery wagons and trucks started, and seven succeeded in surviving the two days' test. A 40-mile course was traversed each day, in three stages—one of 20 miles north from the club house in 58th Street to 230th Street and back, and the second and third down Broadway to Canal Street, thence west to West Street, to the Battery, and back Broadway and Fifth Avenue to 58th Street. The 40 miles were covered the first day as far as possible without stops; but the second day, each vehicle was obliged to make from ten to one hundred stops, according to whether it was a heavy or light machine. The lighter cars made the best runs and had the least trouble. Among these were two Knox delivery wagons propelled by the Knox air-cooled gasoline motor. One of these cars had a double-cylinder 16 horse power motor. Its weight was 2,300 pounds, and it carried a load of 1,250 pounds. It was the first to finish on both days, its time for the 40 miles being 3 hours, 35 minutes, and 3 hours, 41 minutes, the second inclusive of one hundred stops. The other Knox car, propelled by an 8 horse power motor and weighing 2,070 pounds, carried a load of 3,315 pounds, and finished third (time 4 hours, 37 minutes) the first day and second the second day in 4 hours, 55 minutes. A Mobile 4½ horse power steam delivery wagon, weighing 1,500 pounds and carrying a load of 775 pounds, finished second in 4 hours, 23 minutes the first day, and third in 5 hours, 10 minutes the second day.

The only vehicle in the electric class was a 6 horse power Waverley delivery wagon. This car weighed 2,420 pounds, and carried a load of 1,210 pounds. It covered the course in 6¼ hours elapsed time the first day, and 5 hours, 18 minutes, inclusive of 100 stops, the second. The first day it was halted and charged 20 minutes, and the second, 40 minutes, during the run.

Among the heavier vehicles propelled by a gasoline motor, were two entered by the Union Motor Truck Company, of Philadelphia. One of these was an express wagon like that illustrated in our recent Automobile number. Its weight was 4,525 pounds, and its load 2,710 pounds additional. Its time the first day was 10 hours, 34 minutes. After covering 20 miles the second day, one of the solid rubber tires came off, causing the wagon to skid suddenly into a sandy spot in the road and throw off the operator and observer, the latter of whom sprained his ankle. The 5,810-pound truck entered by the same company, was, like the express wagon, also propelled by a four-cylinder, 20 horse power gasoline motor. It carried its load of 3,240 pounds the required distance of 30 miles in 7 hours, 51 minutes the first day; but it, too, came to grief on the second day after going 22 miles and making 22 of the 50 scheduled stops. The driver, when trying to ascend the 230th Street hill, ran the truck into a bad hole, and, when backing out and down the hill, saw a train at the bottom and reversed, fearing a collision. By so doing, he bent the crank shaft of the engine, which was not strong enough to stand the tremendous strain.

As the test was the first in which heavy steam trucks have figured in this country, the performance of these machines was watched with great interest. The starters in this class were a 14,225-pound 30 horse power truck, carrying a load of 5 tons, and entered by T. Coulthard & Co., of London; an 11,160-pound, 20 horse power truck, carrying a 5,740-pound load, entered by the Morgan Motor Company, of Worcester, Mass.; two Hershmann trucks of 15 and 25 horse power, weighing 10,225 and 14,500 pounds respectively, and carrying loads of 3,805 and 10,000 pounds. A 10 horse power delivery wagon weighing 3,530 pounds and carrying 1,720 pounds load, entered by Blaisdell & Co., of Brooklyn, completed the list of steam machines. This machine only got to 161st Street before it was forced to retire owing to pump troubles. It also caught fire from leaking gasoline. The heavier Hershmann truck also quit at the same place, owing to leaky boiler tubes. The other trucks finished the first day's run of 30 miles in the following times: Coulthard, 4 hours, 53 minutes; Hershmann, 6 hours, 31 minutes; and Morgan, 9 hours, 21 minutes. The second day all three trucks again succeeded in covering the 30-mile course, the Hershmann and Morgan inclusive of 25 stops, and the Coulthard of 10, in the folowing times: Hershmann, 4 hours, 57 minutes; Courthard, 10 hours, 28 minutes; and Morgan, 12 hours, 52 minutes.

Thus it will be seen that the two leading makes of American steam trucks compared favorably with the English one; although the American builders are as yet in the experimental stage. The detailed results of the test, such as fuel and water consumption, we hope to give in a later issue.

Electrical Notes.

The John Scott legacy medal and premium was recently awarded by the Franklin Institute to William J. Hammer of New York, for a remarkable experiment in the phonographic and telephonic transmission of sounds between New York and Philadelphia. Two Edison phonographs, two Edison carbon transmitting telephones, two Edison motograph receivers or loud-speaking telephones, two sets of induction coils and batteries and 104 miles of long-distance telephone circuit, 6 miles of which was underground and submarine cable, and 98 miles of which were strung on poles, were employed. The sounds, consisting of talking, singing, and cornet playing, were transmitted through the air five times, and were transmitted through no less than fifteen distinct media from the speaker and musician in New York to the audience in the Franklin Institute, Philadelphia. These media included vocal chords, cornet, air, glass, iron, and mica diaphragms, carbon buttons, styli of steel, palladium, fixed pins or springs, hydrogen gas, distilled water, wax and chalk cylinders, copper wire and the mechanism of the ear. The physical characteristics of the sound waves were changed during transmission no less than forty-eight times. It is interesting to note that the same lecturer, by means of transmitters placed upon the stage, was listened to by audiences in fourteen different cities. Music and talking were transmitted by the phonograph and telephone from the stage of the Franklin Institute to Buffalo, Rochester, Boston, Syracuse, New York, Newark, Orange, and elsewhere.

Treatment of diseases of the eye by electricity has been tried as long as electricity was first scientifically employed in therapeutics. Nevertheless, the advantages of this treatment are very little known. Dr. von Reuss deserves credit for referring to Prof. Mendelsohn's monthly Die Krankenpflege, in a detailed article on partly successful experience in electrical treatment of diseases of the eye, made by himself, which he strongly recommends to his colleagues. Without entering into special information chiefly intended for physicians, one point from the experience of the author has to be set forth. According to his statement, there is no doubt as to the sedative effects of electricity upon a diseased eye, particularly in cases of inflammation. At first electricity was used in diseases of the ophthalmic nerves and muscles of the eye, but in these cases Dr. von Reuss could not secure positive results. Most remarkable, however, are the improvements observed in treatment of inflammatory diseases of the eye by electricity. A great advantage is offered by the treatment being simple and not at all disagreeable. As almost every physician with a large practice owns an induction-coil, he need purchase no new instruments. In order not to make the patient afraid of the action of the electrical current, the physician uses the faradaic hand (named after Michael Faraday). For this purpose the physician touches with one of his hands the diseased eye, while the other hand holds one electrode and the patient the other one of the apparatus. Except a prickling feeling in the hand which clasps the electrode, the patient does not feel anything; nevertheless, the action of the electrical current is so annoying for the physician, that he can not continue one sitting for a longer period than three to five minutes. The electrical current can in case of necessity be brought in direct contact with the eye by a compress tied upon the same. The patient can also in this way regulate the current according to his liking to prevent its becoming disagreeable. The whole affair, including the fixing of the electrode (compress) upon the eye, offers no difficulty, so that the patient may treat his eyes at home without the presence of the physician, which is of greatest value in cases of inflammation of the eyes where violent pains set in during the night. In nearly all cases pain disappears almost instantaneously and ceases for a long while. Dr. von Reuss recommends electrical treatment first of all in cases of iritis, corneitis, and choroiditis. The influence of electricity in removal of photophobia, which is due to a certain kind of conjunctivitis, by which the eyes cannot be opened, has been astonishing. Even upon blind eyeballs, which remain sometimes very painful, the electrical current exercises an extremely beneficent effect.

© 1903 SCIENTIFIC AMERICAN, INC.

Correspondence.

India's Unsanitary Milk Supply.

To the Editor of the SCIENTIFIC AMERICAN:

I think some of your readers will be interested to learn that there is not one refrigerator car in all India, and that we have to take our milk supplies from local cattle stables that are anything but wholesome. Six years of plague have not made very much impression on the survivors as far as active sanitary precautions go, and we may have to look to American enterprise for our first refrigerator cars.

Our current issue of the Indian Municipal Journal sent herewith describes the situation of the milk supply of Bombay and in the other large towns of India.

JOHN WALLACE, C. E.,
Editor of the Indian Textile Journal.

Bombay, India, April 25, 1903.

On Stropping Razors.

To the Editor of the SCIENTIFIC AMERICAN:

Most people that shave themselves have trouble in keeping their razors sharp. For the benefit of such I will give the simple way I have of keeping my razors in shape.

Everyone knows that metal expands with heat. I put my razor, handle kept out, just before stropping, in boiling water, and leave it until it has absorbed as much heat as I can stand in handling. While the blade is hot I strop it well. The metal cools as I strop. In about twenty-five strokes the edge is sharpened and is keener when cold, for the metal contracts while sharpening. The canvas side of my strop is smeared with putz pomade, which I use if the razor is too dull; since it simply brightens the edge and wears it down just enough. LEON RIGGS.

St. Joseph, Mo., May 14, 1903.

A Word Against the Metric System.

To the Editor of the SCIENTIFIC AMERICAN:

The editorial, "The Metric System," in your issue for May 16, mentions two of the reasons why the system is opposed, but fails to mention the reason which leads all others in importance, namely:

The substitution of the millimeter for the inch involves the abandonment of all mechanical standards based on the inch.

This proposition was discussed at length in my paper on this subject, which was read at the last meeting of the American Society of Mechanical Engineers. In the discussion, which occupied an entire afternoon and evening, no rebuttal worthy of the name was offered. Such rebuttal is in fact scarcely possible, since the proof is not based on deduction merely, but is a simple matter of experience. To the extent to which American and English manufacturers have used the metric system, to the same extent have they abandoned sizes and standards based on the inch. Germany uses English pitch threads almost exclusively, and she measures them just as we do—in inches. In other words, in order to retain English threads, Germany is obliged to retain the English inch, as we must retain it if we are to save our standards.

Your comparison of American and English money is part of the metric stock in trade. As my paper has it:

"The superiority of the decimal system as applied to currency is largely due to the great amount of adding to be done. With day book, journal, ledger, cash book, trial balance, balance sheet, invoice inward and invoice outward alike, it is add, add, add, and then add some more. One bookkeeper in a good-sized factory office will do more adding than the whole shop and drawing office force combined. When it comes to multiplication or division, vulgar fractions are often the simpler."

If your readers doubt this, let them multiply or divide some number by 1-3 and then by its decimal equivalent .3333+, or even by ¼ and then by its equivalent .25.

The metric advocates should get over the idea, which is unworthy of intelligent men, that the opposition to their system is based on simple purblind conservatism. It is based on the desire to save our system of mechanical standards, which is worth a thousand-fold the value which the metric advocates claim for their system and a million-fold its actual value. This system of standards is the result of half a century of laborious effort, and on it, more than any other one thing, American manufacturing supremacy depends. F. A. HALSEY,

Associate Editor American Machinist.

New York, May 20, 1903.

Radium Phenomena Considered as "Ether" Effects.

To the Editor of the SCIENTIFIC AMERICAN:

Self-luminosity, power to discharge electrified bodies at a distance, unclassed or abnormal radiation phenomena, generally analogous to X-ray effects, are remarkable attributes of radium compounds, differentiating the element to which they are due from the great body of the other elementary substances.

Now, according to a cablegram published in Melbourne on the 26th of March, the London Times is responsible for the statement that the discoverers (M. and Madame Curie) of the element have demonstrated that without combination, chemical or molecular change, it maintains a temperature 2.7 deg. F. above its surroundings.

If a system of elimination shows—apparently it has shown—that there is no slow process in action, giving rise to the effects by the expenditure of an initial store of potential energy as radiant force, tending ultimately to cessation by exhaustion; and if energy in recognizable form does not pass from adjacent bodies to a "self-luminous" and "self-calorescent" specimen of a radium compound, yet in this particular case the possibility remains that some obscure, or perhaps extra-terrestrial cause, may suffice to produce the effects noted, and in a manner strictly compatible with the established theories of heat and the conservation of energy.

Considering "self-calorescence"—the other radiations may be dealt with on similar lines—heat is one form in which the expenditure of mechanical force becomes manifest to the senses. The connection between the heat developed and the energy expended, is a perfectly definite and well known quantity; hence when a certain amount of heat is constantly given off, it points to the fact that an equivalent amount of energy is constantly being transformed. If a body offer a resistance to movement through any medium, then that resistance is made evident by a rise in temperature exactly equivalent to the kinetic energy, or energy of motion required to overcome the opposition.

The writer would suggest that this offers a clue to the radium phenomena, and would advance—always presuming the verification of the reported thermal effects—as a simple explanation, the following hypothesis:

If in its primordial composition—not necessarily atomic, questions of sub-atomicity may be involved—a mass of radium be dissimilar to a similar mass of another element (not possessing radium characteristics) in relation to a different resistance to motion relative to the "ether," then the observed or reported effects would simply indicate a process of transference and redistribution of energy. The earth's potential energy of motion would here be the source drawn upon to overcome the resistance offered by the "ether" to a mass of radium, the accompanying equivalent effects would naturally appear to be attributable to the radium as an origin.

Given planetary velocities, as in the case of the earth's motion, then, on account of the magnitude of the velocity factor in the velocity-resistance equivalent to the slight heat produced, the resistance factor might be exceedingly small; so small that in ordinary tests it would be altogether masked by other effects, yet not necessarily so small as to escape detection if made the particular object of research by the use of the exceedingly sensitive instruments* now available.

Astronomical data defining the earth's constants are fully tabulated, therefore it may be found that, given sufficiently delicate instrumental means, or efficient thermal insulation, insuring a constant temperature when the force causing radium activity is constant, the periodic variations of the componental planetary motions may be reproduced as corresponding thermal or deflection variations.

The drift of the solar system in reference to the inter-stellar medium is, from the astrophysical standpoint, a subject well worthy of investigation, and radium may supply an analytical method. The drift might, however, introduce an element of complexity, possibly negligible, but conversely it might prove dominant and of such great magnitude that the resistance factor would inversely become infinitesimal and unmeasurable.

The experimental pursuit of these problems would eventually be a series of researches upon disturbed "ether" "streams," and if the results were not altogether negative, would tend to cast some light upon the long sought physical relations of that medium in its fundamental connection with light, heat, electricity and other radiant forces.

That similar resistance effects to those under discussion have not been connected with the other elements is not remarkable; they must necessarily, if existent, be minute, and have not been specially sought. Analogously the "new" elements themselves have only recently been separated, although any one of a myriad of the preceding close analyses might have revealed them.

If speculation be extended into the field of elemental evolution, it might be surmised that the better known elements have been subjected to, or are the outcome of, a common formative process, and have attained a general equilibrium of action in regard to the surrounding ether. The consequent conditions would then form the environment to which, through countless generations, the human senses had become attuned, hence their constitution of a neutral or normal state, not recognized as existent, except by comparison with some unusual, or perhaps, extra-terrestrial standard.

If it be established that radium offers a particular resistance to the "ether," then whether its lines prove present in the solar or stellar spectra, or not, it might, inferentially, be deemed to have had an origin in some region, possibly beyond the star depths, where the physical environment is not that known to man.

The writer fully recognizes the speculative nature of the hypothesis put forward; so far as he is aware, it breaks new ground. The pages of the SCIENTIFIC AMERICAN may bring the matter within the cognizance of those who possess the appliances necessary to put the question to a crucial test. If the hypothesis be verified, important results might be looked for; if disproved, new facts could hardly fail to be brought to light in the process, and thus time devoted to the experiments would still bear fruit.

JAS. ALEX. SMITH.

Melbourne, Australia, April 8, 1903.

* I. e. the quartz film suspension system of Prof. Vernon Boys. Proc. Royal Institution of Great Britain, 1889, Vol. XII, part III, and the Phil. Mag. 1895, Vol. 186.

The Current Supplement.

With an article by Day Allen Willey on the Cod Fisheries of Newfoundland, the current SUPPLEMENT No. 1430, is opened. Excellent illustrations elucidate the text. "Mechanical Traction on Tramways" is the title of an article which deals with a new system of propulsion employed in Paris. Mr. Cyril Davenport gives a brief history of personal jewelry. Selenium is a substance which, by reason of its remarkable electrical property of varying in conductivity with the amount of light by which it happens to be illuminated, has been made the subject of experiments since the days of Berzelius. In a most instructive article accompanied by many clear illustrations, William J. Hammer describes the results which have so far been obtained with this remarkable substance. His paper may well be considered the most exhaustive which has so far appeared on the subject. Dr. McPherson tells something of Lord Kelvin's new idea about ether atoms. Two novel types of traveling electric hoists are described and illustrated. Emile Guarini presents a lucid account of the Perret electric clock. Sir Oliver Lodge's paper on electrons is continued. The usual trade suggestions from United States Consuls and Selected Formulæ will be found in their usual places.

A Memorial to Bessemer.

A movement is on foot in England to establish by popular subscription a memorial to Sir Henry Bessemer. That some recognition is due to the man who reduced the cost of steel from $250 to $20 a ton in less than half a century, goes without saying. The scheme has not as yet been fully developed; but the memorial will doubtless take the form of an institution for instruction in the various branches of metallurgy, under the direction of the University of London. A public meeting is to be held on June 29, at which it is to be determined what plan will be adopted.

The First Municipal Exhibition.

On May 20 the King of Saxony opened the German Municipal Exhibition, the first of its kind ever held. Exhibits of 128 cities were on view. Over 300 manufacturers displayed articles employed in municipal work, street improvement, sewage systems and the like. From the seaport towns models of docks and harbor works were sent. Among the noteworthy exhibits may be mentioned plans of city halls, street car tracks and elevated railway systems, public parks, sewage and drainage systems, municipal slaughter houses and garbage crematories.

Human Rays.

It is announced by Prof. Arthur W. Goodspeed, of the University of Pennsylvania, that he has been experimenting with rays emanating from the human body. Although photographs were made by the aid of Crookes tubes, it is asserted that the tubes were not the actual means of producing the photograph, but that they acted simply as intensifiers of the rays. Prof. Goodspeed is said to have ascertained that the rays from the human body pass with difficulty through glass and with ease through aluminium.

"Buddeized" Milk.

A Swedish pamphlet describes a process of "Buddeizing" milk, which process tends to sterilize and conserve the milk so that it can be kept fresh for any length of time. The inventor is a certain Mr. Budde; hence the name. The pamphlet says that he has proven that the enzymes in the milk, together with heat, not exceeding 55 deg. Cent. nor less than 48 deg. Cent., have the power of decomposing hydric dioxide into water and oxygen, and that at the generation of oxygen, microbes and spores are entirely destroyed.

© 1903 SCIENTIFIC AMERICAN, INC.

FIRST RACE OF THE CUP DEFENDER "RELIANCE."

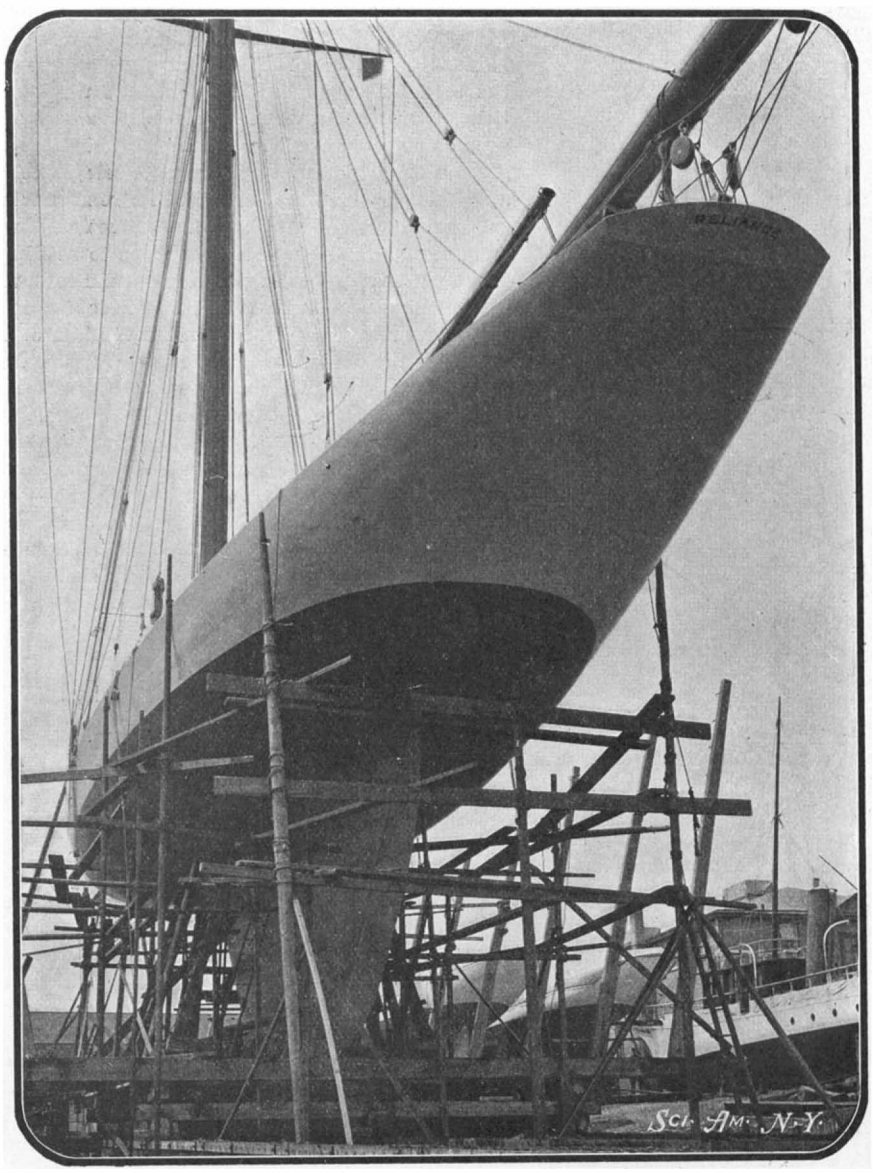
Surely in all the long history of trial races, whether between cup defenders in America, or between cup challengers in their try-outs in British waters, there was never a race sailed that provided such sensational results as were achieved by the new yacht "Reliance" in her first trial race on Long Island Sound. In the first place, none of the American defenders has come to the line with so little actually known as to her sailing capabilities. Because of keen rivalry between the three contestants for cup-defending honors this year, neither "Constitution" nor "Columbia" has been willing to give "Reliance" any opportunities for those preliminary "brushes" and trying-out "spins" on the various points of sailing, which from time immemorial have been granted as a matter of courtesy by former champions to a new aspirant for cup-defending honors. Hence "Reliance" has been doing all her tuning up in very solitary fashion; and, although to those in charge of her she appeared to be thoroughly satisfactory, balancing well, carrying a light helm, and apparently showing great speed under all conditions of sailing, neither her owners nor captain knew exactly what her abilities were, as she drew near the starting line on Thursday last, and commenced to maneuver for position with that well-tested veteran "Columbia." Because of an accident when being hauled out upon the ways, "Constitution" took no part in the race, being at the time in the shipbuilder's hands for the straightening out of some plates that were slightly indented.

The race was sailed in a perfectly smooth sea and a breeze that varied from a knot or two per hour to a maximum strength of about eight or ten; and, therefore, the conditions were the very best possible for a boat with the broad and shoal body and great sail spread of "Reliance." The course consisted of an 11-knot leg down the Long Island shore with the wind over the starboard quarter; a 3-mile reach across the Sound with the wind over the port quarter; and a beat of 11 miles for home. The greatest surprise of the day was furnished on the first leg, when, with a wind that averaged about 3 knots in strength and never exceeded 6 or 7 knots, "Reliance" drew away very rapidly from "Columbia," gaining at an average rate of 40 seconds per mile. It was supposed that in spite of her much larger sail spread ("Columbia" having 13,200 square feet, and "Constitution" nearly 16,000), the greater weight and larger wetted surface of "Reliance" would cause her to show about the same drifting qualities as the smaller boat; but as it was, she beat "Columbia" about as badly as "Constitution" used to beat her two years ago under like weather conditions. After gibing round the first mark, "Reliance" heeled down to a freshening breeze until her lee rail was well under, and proceeded to show something of the well-known reaching ability of the scow type. Her water-line lengthened some 5 or 6 feet forward and drew out for fully 25 feet under the long counter; and considering that the yacht for the first mile of the 3-mile leg must have been going fully 14 to 14½ knots an hour, she made remarkably little disturbance of the water. There was no perceptible drag, and the bow and stern waves were extremely light for a boat of that size moving at such high speed. On this leg she beat "Columbia" 1 minute and 30 seconds, or at the rate of half a minute a mile. It is possible that some time may have been lost by "Columbia" because of the fact that while "Reliance" carried her jib in addition to her balloon-jib topsail and staysail, the older boat did not use her jib over a considerable part of the distance; but even if allowance be made for this fact, the performance of the new boat was most remarkable.

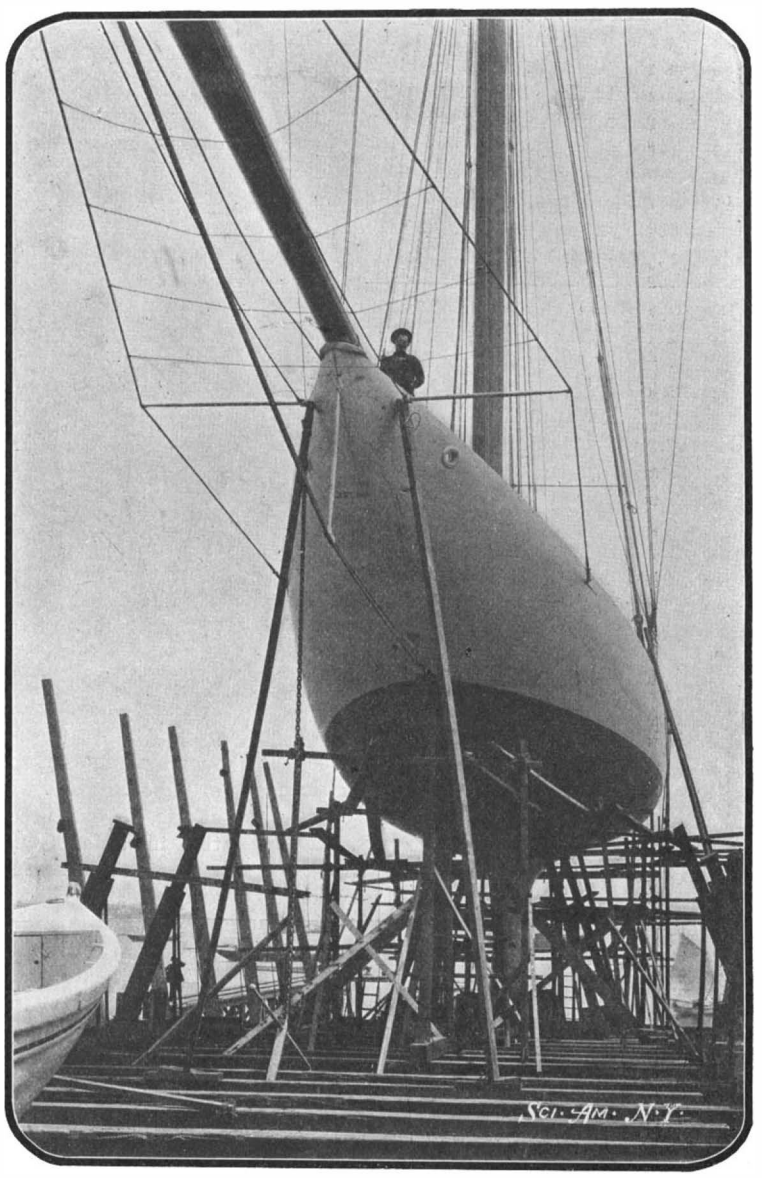
It was expected that when sheets were flattened in for the final thrash to windward, the great ability of "Columbia" on this point of sailing would show itself, and that she would at least hold the big boat, if she did not cut down some of her lead; but, again to the surprise of the yachting "sharps," "Reliance" continued to pull away from her now badly-beaten competitor, and on the 11-mile beat she gained 4 minutes and 23 seconds, which is equal to a gain of about 24 seconds per mile, the speed of "Reliance" being a trifle over 10 knots per hour. In the broad reach over the 3-mile leg of the course "Reliance" averaged 13.2 knots per hour; and it is certain that if the breeze had held at the strength which it had on the first mile of this leg, the new yacht would have shown a considerably higher average speed than that.

We have said that the race was sailed under ideal conditions for a boat of the "Reliance" type, and in all probability she will not be able to pull away from "Columbia" in anything like such an impressive manner when there is a sea running, or when the race has to be sailed under shortened canvas; while the most disadvantageous conditions possible would be the combination of a lumpy sea and a light breeze. As there are yet some dozen or more races to be sailed between the two cup yachts, some of them to take place off Newport and over the cup course off Sandy Hook, this doubt is certain to be satisfactorily settled long before "Reliance" meets "Shamrock III." in an international race.

The accompanying views of the "Reliance" were taken when she was hauled out to clean the underbody for this race. The most surprising feature was the extreme breadth and shoalness of the forebody, the yacht showing up extremely shallow and flat from the forward waterline to the keel. Yet there was no suspicion of unfairness, the lines in every direction appearing to be remarkably sweet, with none of those "humps" or sudden, abrupt changes of curvature that so frequently mar the beauty of extreme boats of this type.



Stern View, Showing the Great Overhang.



Bow View, Showing the Great Breadth and Shoal Body of "Reliance."

THE "RELIANCE" IN DRYDOCK.

The Cape to Cairo Railroad.

The construction of the Cape to Cairo Railroad has now been completed to a point 167 miles north of Buluwayo, and this section of the extension to the Victoria Falls is open for public traffic. The railroad is now only 40 miles from the extensive Waukie coal fields, but of this stretch of track 15 miles of the necessary earthworks are finished. Already the Waukie coal has been experimentally utilized upon a heavy freight train weighing 376 tons, to ascertain its calorific value for this purpose. The run was made from Francistown to Buluwayo, a distance of 126 miles, and the coal was found to be in every way equal to that hitherto employed. One of the characteristics of this coal is that it is remarkably free from clinker, and not once during this particular trip was it found necessary to clean the fire of the locomotive. Even on the stiff gradients the coal consumption was only 58.4 pounds per mile for 376 tons, as compared with 70 pounds per mile for 300 tons with the ordinary coal. The earthworks for the railroad from Buluwayo to the Matoppos, provided for in Mr. Cecil Rhodes' will, are also well advanced, and the other various railroads in connection with the great trunk track through Africa are being pushed forward with great rapidity.

Sir William Ramsay, who, in conjunction with Lord Rayleigh, discovered the existence of argon, and subsequently krypton and xenon, in the atmosphere, has made a computation of the quantity of the two last elements present in the air. The results of his experiments and calculations shows that the air contains .000014 per cent of krypton and 0000026 of xenon by weight. To be more explicit there is one part by weight of krypton in 7,000,000, and one part of xenon in 40,000,000, of air. Measured by volume as constituent gases of the air, the volume of these two elements is more infinitesimal, since there is only one part of the former in 20,000,000, and one part of the latter to 170,000,000 parts of air.

© 1903 SCIENTIFIC AMERICAN, INC.

BUTTERFLY FARMS IN FRANCE.

BY JACQUES BOYER.

Up to within a year or two, the butterfly farm established at Eastbourn, England, by Mr. William Watkins, an entomologist, was the only one of its kind. To-day, however, there exist several such farms in France, among which we desire to call special attention to those of M. André at Mâcon, Department Saône-et-Loire; M. de Labonnefon, at Cercoux, Department Charente-inferieure; and Doctor Hugues, at Chomérac, Department Ardèche.

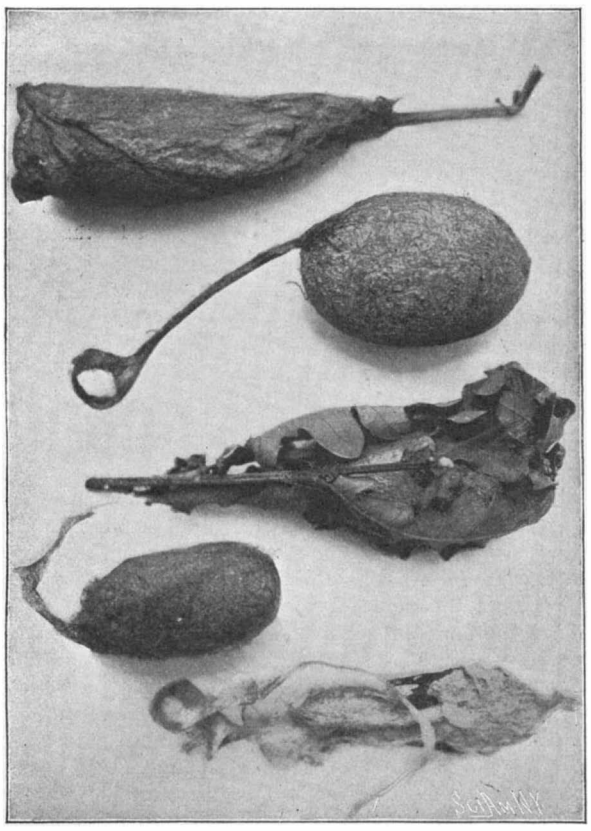


Fig. 1.—COCOONS OF SEVERAL VARIETIES OF SILKWORM.

These gentlemen practically confine their efforts to the rearing of the rarest genera of the family bombycidæ or silkworms; and by fortunate crossings they have obtained some new varieties for which the collectors and the museums of natural history contend with weapons of gold. Moreover, they are endeavoring to acclimate in France the silkworms indigenous to other countries. The silk-producing larvæ will live and reproduce in a wild state in the forests of France, and it is only necessary to collect the cocoons, from which the silk threads are easily obtained.

These attempts at acclimation have in some cases been attended with encouraging results. The ailanthus silkworm, *Attacus Cynthia*, so called because its caterpillar feeds upon the leaves of the ailanthus tree, is a native of Japan; the *Antherœa Yama-Mai*, a native of India, and a most beautiful butterfly whose caterpillar thrives well upon the elm and the chestnut; the *Antherœa Pernyi*, better known under the popular name of the oak silkworms; the *Antherœa Mylitta*, which because of its late hatching or breaking forth is more difficult to raise; and the *Attacus Atlas*, the largest known of the bombycidæ and which produces very large cocoons, have all been successfully domesticated or acclimated. Fig. 1 shows the cocoons of the exotic silkworms which are being introduced in France. 1 is that of the *Attacus Cynthia;* 2, *Antherœa Pernyi*, one having broken out of and one being still concealed in an oak leaf; 3 is the full ovoid cocoon of the *Antherœa Mylitta;* and 4 is the *Attacus Atlas* carefully wrapped up in the leaf. The requisites for the successful culture of the butterfly are a garden of greater or less extent in which are oaks, ailanthus trees, pines, plum trees, ricinus or castor-oil plants, and other bushes the leaves of which serve to nourish the larvæ or caterpillars. Disposed here and there about the garden are various appliances of the most simple kind. Ordinarily the eggs are placed in a brooder such as is shown in Fig. 2. This is altogether a home-made contrivance for preserving the larvæ from destruction and at the same time affording them a means of nourishment after they are hatched.

Branches of the trees with the cocoons still clinging to them are plucked and arranged so that their woody stems may be inserted in a vase of water, the whole upper part being enveloped by gauze or mosquito netting. In the lower part of the netting, where it comes in contact with the stems, is placed a lot of crumpled paper to prevent the wandering insect from taking an involuntary bath. Notwithstanding all these precautions, sometimes the imprudent little beasts fall into the water, and if an attendant with his pincers does not come promptly to their aid, they suffer the same penalty as other mortals who cannot swim. On the other hand, these caterpillars have a most fastidious taste.

They need pure air, offensive odors are detrimental to their health; above all, their food must be sound, succulent and plentiful. They are ravenous feeders, incessant eaters, and consume much more in proportion to their size than an ox. Accordingly, as soon as the leaves in a brooder have been nearly devoured, another one is prepared, placed in a vessel of water, and brought sufficiently close to the first one to allow the insects to change their habitation without great discomfort. They do not require much coaxing—their dominant appetites urge them to possess the new fields. Since a uniform temperature is an important factor in the rearing of these insects, they are very often kept in a room until after the first moulting. They are then placed on bushes in the open air, and to shield them from the birds and another equally deadly enemy, the *Forficula auricularia* (earwig), the branches containing them are inclosed in a sort of sleeve of muslin or tulle. In Fig. 3 can be seen several of these sleeves with the attendants inspecting them. This represents an actual scene on the farm of M. André, at Mâcon.

The breeding of butterfles is not accomplished without work. The attendants must take care that sufficient nourishment is constantly at hand, which, in view of the incessant craving for more on the part of the boarders, is no light task. Besides, it is necessary to frequently remove the excrement from the muslin envelope. After the bodies of the caterpillars have attained a certain thickness, the enveloping hood is removed, there being no more fear of the beaks of the feathered tribe, as they are not eager to make a meal of such oleaginous morsels.

As for the more robust species, such as the *Telew-Polyphemus*, imported from Asia, or the *Attacus Cynthia*, indigenous to Japan, it is only necessary to place the grain or eggs upon the trees in paper cornucopiæ attached to the trees, bell down. Hatching follows without further care, after which the cocoons that are found rolled up in the leaves or hanging from the branches are gathered. Well protected from the rats, who are extremely fond of them, the chrysalides are now brought in and stored in a dry and well ventilated place. If the eggs are desired for the next season's hatching, the cocoons are placed in grilled boxes, where the butterflies emerge from them at birth.

Fig. 3.—PLACING THE SLEEVES AND THEIR CONTENTS ON THE BUSHES.

Should it be the desire of the breeder to mount the butterflies for the museum, he first asphyxiates them in a vial containing potassium cyanide. Once dead, they are mounted on stands with wings carefully and completely distended. To prepare the caterpillars for the entomologist's cabinet is quite another thing. The best process for preserving them is by inflation, a manipulation which requires no little dexterity and patience. Fig. 4 shows M. André in the act of inflating a caterpillar. Before this can be done the insect must first be prepared by pressing it between sheets of paper, and, after all the soft parts of the body are expelled through the posterior opening, by making an incision with a scalpel in the large intestine 2 or 3 centimeters from the end of the body, the latter is threaded, so to speak, upon the fine point of a thin glass tube, which is connected by its other end to an ordinary rubber spraying bulb, or any bulb provided with valves for the admission and ejection of air. The one shown in Fig. 4 is a combination of two bulbs and an idea of M. André, the naturalist.

Moreover, during the inflating process, the subject is placed in a little stove or oven heated by an alcoholic lamp, shown in the figure just in front of the operator. After a few minutes the caterpillar begins to assume the appearance of life, and it is then ready to be placed in an entomologist's collection.

Various other openings of an industrial or artistic nature are available to the French "bombyculturist." The butterflies are worked into brooches or even into highly ornamental cathedral windows by placing, for example, some *Actias Mimosæ* and other insects, together with some desiccated flowers and leaves, between panes of glass.

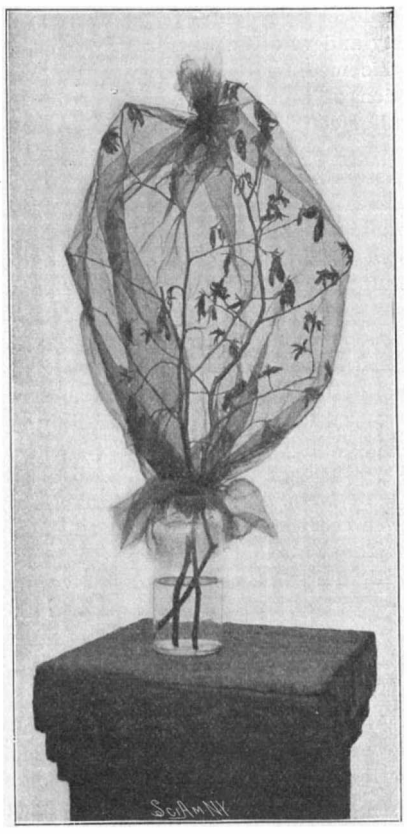


Fig. 2.—A BROODER.

Our elegant dames also affect a gorgeous decoration of their hats with butterflies, for which purpose the insects must undergo a certain extensive preparation. After the wings have been covered with a transparent alcohol varnish, the butterfly is glued upon a piece of satinette which is afterward cut out to conform exactly to their contour. A steel or silver wire is run through the thorax, forming a skeleton at once rigid and light. Mounted in this manner, the butterflies become a very attractive and graceful ornament.

Automobile Improvements.

Some ingenious improvements have been made by Sir David Salomons, Bart., the pioneer of the motor car movement in England, in connection with the vital parts of a petrol car, to facilitate and expedite inspection of the engine, and replacement of parts. Instead of attaching the ignition wire to terminals of the plug, as is the usual practice, Sir David Salomons has devised an intermediate piece which he can disconnect from the plug by the half-turn motion, similar to that in the withdrawal and insertion of an ordinary incandescent electric lamp into the holder. By this arrangement, the plug can be instantly removed by the hand, for examination or cleaning. Another important time-saving improvement he has also made is concerning quick access to the valves. In many petrol engines it is necessary to detach by unscrewing two unions, and to remove a copper pipe. This pipe he has cut in two, and attached a single union provided with a coarse thread, and has so arranged the screw collar that it may be released by the hand without the aid of a tool. In his car he has also removed the tap controlling the supply of petrol from the tank of the carbureter, from its general position near the reservoir to the point where the pipe enters the carbureter. This is a valuable improvement, since by the existing practice the supply pipe, when the tap is turned off, often contains a quantity of air, which prevents the passage of the petrol from the tank to the carbureter, and thus delays, and militates against, the starting of the motor, since the petrol cannot enter the carbureter.

Fig. 4.—INFLATING A CATERPILLAR.

© 1903 SCIENTIFIC AMERICAN, INC.

The Interior of the Earth.

Prof. John Milne, the well-known seismologist, has published some interesting facts concerning the crust and interior of the earth. At the present time it is only possible to imagine the formation of the earth's crust from the strata present in the matter thrown out by volcanoes. How thick the earth's crust is we do not know, but as it is an established fact that earthquakes and similar earth tremors pass right round the world, through the interior in waves, it is possible to deduce the medium they have traversed by their quality and velocity. According to Prof. Milne, the denser this medium the greater is the speed of the propagation of the waves, varying from 3 kilometers to 9.3 kilometers per second, the velocity increasing the nearer the course of the wave to the earth's center. Assuming the world to weigh more than five and a half times an equal bulk of water, Prof. Milne concludes that a lighter crust of approximately 200 miles and a denser medium fairly uniform and about five and a half times the density of water would satisfy the seismological conditions. To such a core as this, which would be somewhat lighter than iron, he has supplied the special name of "geite," and continues to explain that what seismological observations lead us to suspect is that beneath the lighter crust there is a magnetic medium of greater density, which during penetration slowly passes into a fairly homogeneous "geite," and he anticipates that it will be possible in time to deduce the physical and chemical composition of the white-hot matter in the interior of the earth with the same certainty that we now know the composition of the various bodies of the solar system.

A Chemical Apparatus for the Removal of Boiler Scale.

Among the impurities of feed-water, the sulphates of calcium and magnesium are more especially deposited as a hard crust or scale on boiler-plate. The active means for avoiding this crust or scale is the treatment of the feed-water with soda or other suitable substances. By the action of sodium carbonate there are formed from the sulphuric-acid salts dissolved in the water insoluble carbonic-acid salts of calcium and magnesium. These salts collect on the bottom of the boiler as a coarse mud, and can be easily removed by occasionally blowing off.

The amount of these salts contained in the feed-water can be determined by chemical analysis, and from this the weight of soda or other chemical which must be added to the feed-water can be calculated. It is not always possible, however, to undertake these chemical investigations, for in most cases the boiler attendants lack the necessary knowledge of chemistry. Consequently an arbitrary quantity of chemical is usually added.

An inventor who lives in Rotterdam, Ferdinand R. K. Erfmann by name, has devised a controlling apparatus, by the aid of which the amount of chemical that must be added for a ton of boiler water can be determined in the simplest manner and in a very short time. The operation of the apparatus is based on the following principle:

A definite quantity of boiler water is caused to react on a definite quantity of basic solution of a definite strength, so that a precipitate is formed. This mixture is filtered. It is then determined how much of the basic solution still remains in the filtered liquid; for this purpose the base is colored yellow, by adding an indicator (methyl orange). If the base be now neutralized by an acid, the indicator will be colored red by the acid at the moment when the neutralization is complete.

These experiments can be carried out with the new apparatus, very simply. The number of pounds of chemical which must be added per ton of boiler water can be read off on a scale.

New Quick-Firing Gun for the British Army.

Both the artillery and field forces of the British army are being equipped with a new type of quick-firing gun of ingenious design. The gun itself, which is of 20-pounds caliber, is both heavier and longer than those employed in the South African war, and is equipped with several new quick-firing accessories. Yet despite these increases there has been no augmentation of the total weight of the arm, and it will not require any additional horse power for transport.

At the end of the trail of the gun is a simple spade, supplanting that which has hitherto been attached to the axle, the feature of which is that it does not act as a check to the recoil of the gun. This is a grave disadvantage to the axle spade, since every time the gun is fired the force of the discharge drives the spade deeper into the ground, and renders it impossible to move the gun quickly when desired, as the spade has to be first released.

Instead of the spade bearing the brunt of the recoil, there is a special mechanism which allows the gun itself to slide back when fired in a semicircular bed, and neither the position of the carriage, nor the training of the gun, is altered in the slightest. The gunners are also afforded protection against the enemy's fire by steel shields.

Two other improvements have been carried out, which will enhance the firing capacity of the gun to a very appreciable degree. A breech-block has been designed which is not liable to corrosion, and which therefore will not blow back when worn. This constitutes a grave objection to the Ehrhardt gun cone-shaped breech-block, which after continuous firing blows back. In this new army field piece also the breech is closed and opened by one rapid and single action, which is quickly and easily performed, so that the interval necessary between opening, loading, and firing the gun is reduced to the minimum.

A MAN WHO WAS STRUCK BY LIGHTNING AND LIVES.

P. D. Keim and his son, Clyde, of Rand, Col., went upon a mountain hunting trip last summer. While the party was ascending a steep incline a storm came up. As he walked into a clearing, the elder Keim was struck by lightning. Nearly every article of clothing that he wore was torn off; even his shoes were stripped from his feet. His son Clyde, who was about fifty feet away, was also struck. He regained consciousness, and, despite the fact that one side was paralyzed, he managed to crawl to his father, whom he supposed dead—pulling himself along by means of the long grass, using but one hand and arm. When he reached his father, he found that he had not been killed. Fortunately, the remaining members of the

THE EFFECT OF A STROKE OF LIGHTNING.

party came up, and worked over the unconscious man for two hours, finally succeeding in reviving him.

The body of Mr. Keim was burnt from neck to toes; both ear drums had burst. After he had been revived, Mr. Keim and his son Clyde boarded the train for Rand, Col., where they live. On the way, however, it was necessary to call in medical assistance. Mr. Keim wrote to us last January that he had then sufficiently recovered to don the clothes which he wore at the time of the accident, and to have the picture taken which we reproduce herewith. The picture tells better than words how narrow was his escape.

Borax, which is so largely used in the arts, and for household purposes as well, is found in many parts of the world in a more or less pure state, and the process of separating it from the crude mineral is very simple. A first operation is grinding the material in boiling water containing a small portion of calcined carbonate of soda. The clear solution thus obtained is run into tanks and crystallized. This is only fifty per cent borax, other elements being sulphate of lime and common salt. The crystals obtained by this process are then put through another process by heating them to a certain temperature at a given concentration, when the borax proper crystallizes out, and separates from the impurities held in suspension, the mother liquor being drawn off. Borax has been found in such quantities of late years that it has declined greatly in price; at one time it cost over $200 per ton, but is now but a fraction of that sum.

Engineering Notes.

Prof. Thurston believes that the gas engine is a formidable rival of the steam engine and is capable of further development. Each has given a horse power for about one pound of coal, and the efficiency of both, between the coal pile and the point of delivery, is about 20 per cent. The steam engine, he says, has so nearly reached its limit that further progress under commercial conditions would seem to be very slow, but its range may be increased by employing very high pressures and superheating combined with them. In Sibley College work, 1,000 pounds per square inch have been used, and Prof. Thurston expresses the view that twice that pressure may be successfully used eventually, or with sufficient experience in its management. These factors would raise the efficiencies nearly 50 per cent and reduce the coal per horse power hour to about three-fourths of one pound.

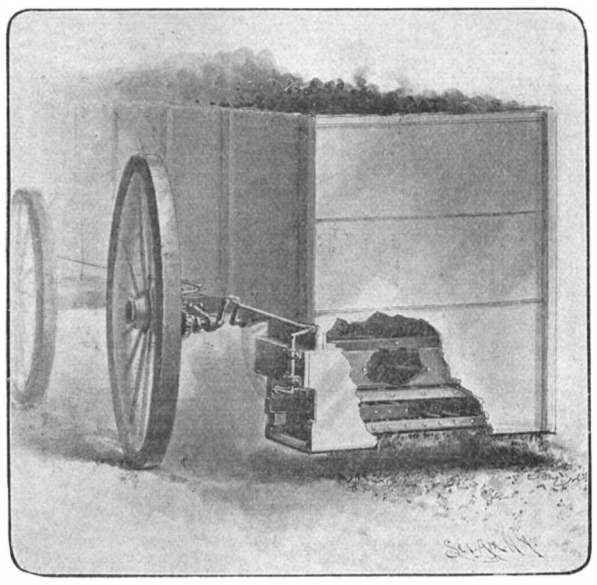
One of the principal difficulties of adapting the steam turbine to marine use lies in the necessity of providing some arrangement for reversing the motion of the ship. In the case of light launches a similar difficulty has had to be faced, but for the small powers and speeds here needed it has not proved difficult to construct reversible propellers, a hollow shaft being used in conjunction with pivoted blades. Such a system seems, however, hardly applicable to the transmission of the heavy thrusts involved in the case of high speeds and large vessels. Consequently some attention is now being directed by one or two large firms to the construction of reversing turbines. The difficulties in making these are purely mechanical, since from the point of view of efficiency it matters little whether the turbine wheel rotates in one direction while the casing is held fast, or whether the latter is allowed to revolve in the opposite direction and the turbine proper held fast. The relative motion of the steam through the guide-blades and buckets is identically the same in the two cases, though in the second case the steam should be introduced into the casing with an angular velocity equal to that of the casing, and a corresponding arrangement should be made at the exhaust end. A writer in London Engineering suggests that by coupling up through friction clutches either the casing or the turbine wheels to the propeller shaft, the latter could be driven in either direction at will. The writer states that he is unacquainted with the principles on which the firms above mentioned are at present experimenting, but the governing ideas are probably somewhat on the above lines.

An aerial transportation system which is in use in Italy is described in the Bulletin des Ingenieurs Civils. It has been installed by the factory of G. Pratti at Longara. At the end of 1900 a cardboard factory was established in the valley of the Piave, using wood pulp. In order to use hydraulic power the plant was located at the bottom of the valley. The national route by which the raw material was brought and the products transported lies 2,300 feet away on a horizontal distance and is 64 feet higher than the factory. Hence the problem of transportation had to be studied; the aerial rope system was preferred, as it was necessary to cross the Piave, then two roads and a large field. An aerial cable was stretched upon which travel the cars. It is 2,340 feet long and has a difference of level of 78 feet between the ends. The two parallel cables are fixed by anchorage at the upper part and are stretched by counterweights at the lower. The cables are fixed along the route upon wood pylons from 18 to 50 feet high by cast-iron brackets. The cable is one inch in diameter and made up of 37 steel wires; the two cables are placed 6 feet apart. For the traction a continuous cable is used, of 0.4 inch diameter. It runs over pulleys fixed to the pylons underneath the supporting cables. The lower station has a horizontal pulley of 6 feet diameter upon which runs the traction cable. A small turbine operates it by a set of gearing which allows a forward or reverse movement. It takes about 4 horse power. At the upper station is a horizontal pulley over which the cable passes. This pulley has a shaft whose bearing can be displaced in a slide, and a counterweight attached to the latter gives the proper tension to the cable. The material is conveyed in small cars; it consists of packages containing 200 pounds each which are taken from the factory to the national route and of sawed trunks of trees carried in the opposite direction; these are about 15 feet long and the weight carried reaches 2,200 pounds. Two cars are constantly in circulation on this line; one leaves from above and the other from below, and they cross in the middle. The speed is about 5 feet per second and it takes 8 minutes to make the trip. The loading and unloading takes 4 minutes, giving five trips per hour for each car. This represents a capacity of 10 tons. A special model of car has been designed for receiving the bales and the logs. The latter are hung underneath by two stout hoops. The whole is supported from two rolling chariots. The cost of the plant, which has been put in by Ceretti & Tanfani, of Milan, is $5,000. Its operation has proved very satisfactory.

© 1903 SCIENTIFIC AMERICAN, INC.

MANURE SPREADER.

It is important that manure and other fertilizer of a lumpy nature be crushed before spreading on the ground, and with this in view Mr. O. L. Stadig, of St. Francis, Me., has invented a simple crusher which may be readily attached to any wagon or cart. As

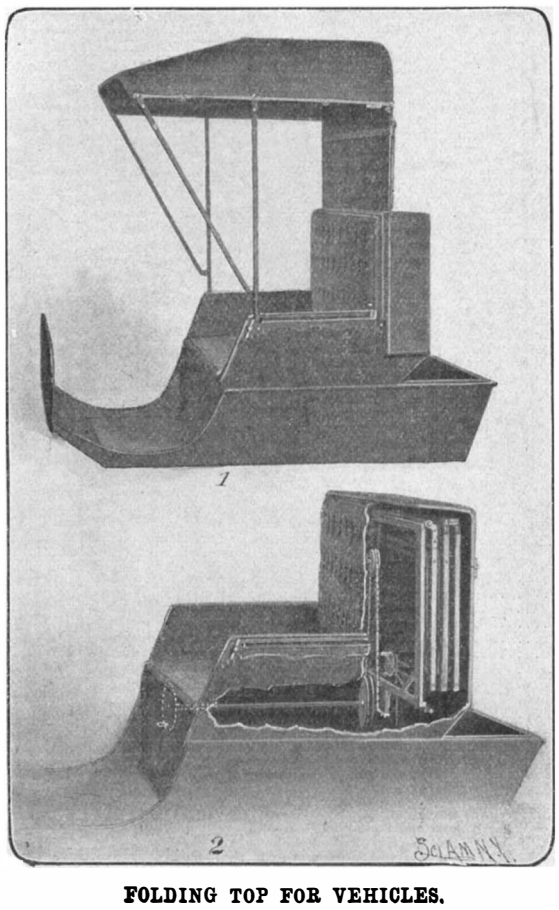


MANURE SPREADER.

illustrated the crusher comprises a number of reciprocating frames mounted in grooves at the rear of the wagon body. The frames are composed of longitudinal and transverse bars and pass between similar stationary frames in the wagon. The reciprocating frames are operated from one of the rear wheels of the wagon as follows: Near the axle of the wheel a crank shaft is journaled, on the outer projecting end of which a pinion is mounted. The pinion is not fixed to the shaft but may be moved thereon into or out of engagement with a gear ring bolted to the spokes of the wheel. This action may be governed by a lever at the driver's seat. With the gears in mesh the crank shaft will be rapidly rotated when the vehicle is in motion and the pitman on the crank portion will be reciprocated. This motion is transmitted by means of levers to the movable frames, causing them to reciprocate and grind or crush the manure in the wagon against the stationary frames. The manure then falls through and is distributed evenly on the ground in the proper broken condition.

FOLDING TOP FOR VEHICLES.

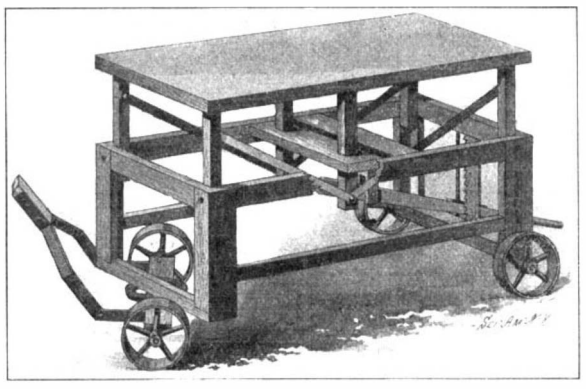
A convenient way of disposing of a buggy top when it is not in use has been provided by the recent invention of Messrs. William T. and Edward Y. Temple, of Trenton, N. J. The top is moved back to folding position, and then by the manipulation of a crank under the buggy seat is lowered into the hollow seat-back. The operating crank is secured to a shaft, which is provided at its opposite ends with a grooved pulley. A chain secured at one end of this pulley passes over a sprocket wheel at the top of the seat-back and is fastened to the lower end of the rear frame of the buggy top. This frame is also provided with a disk, as illustrated, from which two rods extend to the spring bolts located one at each side of the frame. The spring bolts are adapted to enter notches in the seat-back when the frame has been sufficiently elevated. When it is desired to lower the frame, the disk is rotated by means of a handle in the back of the seat, which causes the connecting rods to withdraw the bolts from their notches. The upright members of the middle bow, it will be observed, are each provided at the lower end with a guide piece adapted to slide in a T-shaped groove in its respective seat-arm. At the rear end of the grooves hinged blocks are provided which, on folding up the buggy top, are swung open to allow removal of the guide pieces from the grooves and permit the upright members to be folded back into the hollow seat-back. The location of joints in the buggy frame has been carefully planned to permit of folding the top as compactly and neatly as possible. With the buggy top stowed away within the hollow seat-back, free access is permitted to the rear portion of the vehicle body, which is often used for carrying packages and other articles.



FOLDING TOP FOR VEHICLES.

ELEVATING TRUCK.

A large proportion of the damage done to baggage in transportation is due to the fact that the floors of the baggage cars are much higher than the platform of the usual hand truck, and consequently the trainmen are apt to carelessly throw out trunks, boxes and packages regardless of their weight or the nature of their contents; but as the train must keep its schedule, and every minute counts, we cannot blame the baggageman for unloading the luggage in the very shortest time possible. An improved type of hand truck, which is calculated to do away with this objectionable feature, is illustrated herewith. It is the invention of H. F. Broyles, of Western Port, Md. This truck is provided with a platform which can be raised up to any desired height by the simple manipulation of a lever, and as easily lowered. With the platform on the level of the car floor, the trunks or other bag-

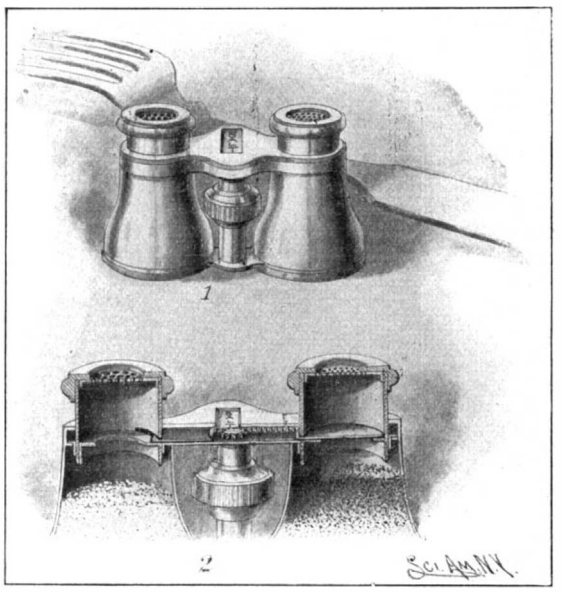


AN ELEVATING TRUCK.

gage can be easily slid along on to the truck, and the platform may then be let down for unloading, or may be adjusted to the level of an express wagon if the baggage is to be delivered immediately. The platform is supported on posts which fit in between the corner posts of the truck frame. The bars which are secured at their outer ends to the platform posts are connected at the center by a rod supported in brackets projecting downward from the platform. This rod passes through the inner end of the operating lever. A forked bracket extending downward from the truck frame affords a bearing for the fulcrum pin of the operating lever. The pin passes through a slot in the lever, which allows necessary play. A plate is fastened to the forward end of the lever, and is adapted to engage the teeth of a ratchet plate to hold the platform at any height desired. A guide rod at one side serves to hold the plate on the lever in engagement with the ratchet teeth. This rod being made of spring metal may be easily sprung outwardly to permit raising or lowering of the lever. Aside from its uses in connection with baggage transfer, this truck will obviously be found very useful for many other purposes.

AN OPERA-GLASS CONDIMENT HOLDER.

A novel form of salt and pepper holder has recently been invented by Lieut. J. W. Graeme, care of the United States Navy Department, Washington, D. C. The holder has the form of a pair of opera glasses, being about half the size of the actual article. One of the cylinders is filled with salt, and the other with pepper. The parts which correspond with the eyepieces of opera glasses form the perforated tops, through which the salt and pepper may be shaken. To prevent both salt and pepper from being discharged at the same time, the inventor provides a plate which is adapted to close the neck of either one or the other cylinder. A rack is formed on one edge of this plate, and is engaged by a pinion at the upper end of what corresponds to the focusing-wheel shaft. By turning the focusing-wheel this cut-off plate may obviously be moved to close either the salt or pepper box. The words "Salt" and "Pepper" are engraved on the plate in such positions that when the salt box is uncovered the word "Salt" will be exposed through a slot in the casing between the eyepieces, and when the other box is uncovered the word "Pepper" will appear. Imitation of the opera glass is heightened by making the bottoms of the boxes in the form of lenses, which con-

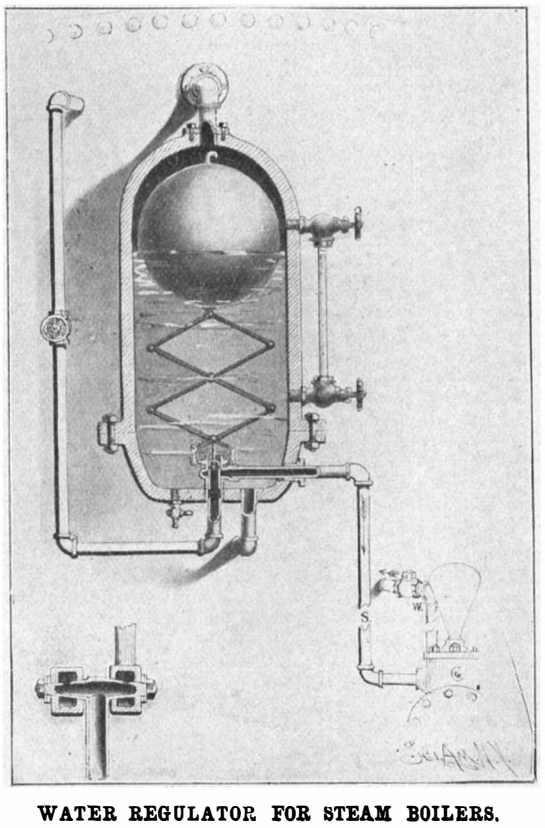


AN OPERA-GLASS CONDIMENT HOLDER.

struction also enables one to see at a glance whether the holder is empty or not.

WATER REGULATOR FOR STEAM BOILERS.

In the accompanying illustration we show an automatic water regulator for steam boilers, which embodies a number of important new features. The float controlling the valve is so constructed as not to be liable to fill with water by sweating or actual leakage, and means are provided whereby the float will not be liable to collapse by reason of the high pressure at the boiler. The inventor, Mr. Benjamin Walker, Jr., of Austin, Texas, has aimed to make the regulator as neat and light as possible. The cylinder or shell of the regulator is made in two sections connected in a water and steam tight manner. A tubular piece screwed into the bottom of the shell, and provided near its upper end with an annular chamber, serves as a casing for a cup-valve. The annular chamber opens into a pipe connected with the injector or pump, which is supplied with steam when the openings in the cup-valve register with this annular chamber. The valve is connected to the float by means of a lazy-tongs made up of tubular members. These are so constructed as to conduct any water which may have accumulated in the float of the valve. Fig. 2 shows the form of connection used for insuring proper communication at the joints of the lazy-tongs. The curved or gooseneck tube at the top of the float admits air or steam therein, to enable it to withstand the high pressure from the boiler. With the parts in the position illustrated the pump or injector is idle, for its steam supply is cut off by the cup-valve. However, as soon as the water in the boiler has dropped sufficiently, the float will lower the valve, permitting steam to flow out through the annular chamber of the valve casing and into the pump. The latter will then pump water into the boiler until the float has again been raised to its normal position.



WATER REGULATOR FOR STEAM BOILERS.

© 1903 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Miscellaneous.

RATTLE.—L. J. BAILEY, Claflin, Kan. In carrying out this invention the inventor makes a rattle-box of a series of plates, interlocked to form a box containing one or more balls. One of these plates is prolonged to form a handle. The other plates are made substantially alike, recessed in one face, providing shoulders near the opposite edges of the plate facing inwardly to overlie and secure the plates which are fitted edgewise thereto.

TOOL FOR PYROGRAPHIC WORK.—Z. N. TYSSOWSKA, Chicago, Ill. In this tool the inventor provides means by which the current of hot gases issuing from the tool may be kept at a high temperature and utilized for burning and scorching purposes in artistic delineation. Means are also provided for projecting the hot gases in a stream and indicating the direction of this stream and concentrating it upon the work.

LIQUID-MEASURE.—H. J. BRANTLEY, Valdosta, Ga., and J. C. BRANTLEY, Marksville, Miss. The intention in this invention is to improve measuring apparatus, especially in that class designed for use in dispensing liquids. The measuring vessel is constructed with a central journal portion and with the reservoir portions on opposite sides of the latter The weight of such vessel and of the reservoir portions are so distributed that the measuring vessel can be easily turned and there will be no twisting strain in the bearing portion of the casing.

FOUNTAIN DRAWING OR RULING PEN.—W. C. PETTEE, New York, N. Y. The instrument invented by Mr. Pettee, has for its object the provision of a new and improved drawing or ruling pen which is simple in construction and arranged to supply ink to the ink-points without the ink unduly drying up. The arrangement permits convenient setting, filling, and cleaning whenever desired.

BROODER.—C. STAAFF, Peapack, N. J. In the operation of this brooder or hover, the heat from a lamp passes into the heating-box along the box at the opposite side and out through a tube. This provides a continuous current of heated air. The air passes into a hood and thence through an opening into a casing, where it is heated by radiation from the heating-box and kept at an even temperature.

MUSIC-HOLDER.—U. C. TERWILLIGER, Islip, N. Y. This invention consists of a simple, light, and practical construction of a holder which is an improvement on that form of music-holder for the use of bandsmen and others which is made in the shape of a pocket with transparent sides, inclosing the music so as to protect it from the weather and yet permit the music to be read through the transparent sides.

CALCULATING DEVICE.—W. T. WILLIAMS, Brooklyn, N. Y. The device contrived by Mr. Williams belongs to that class employed in the solving of problems and known as "calculating devices;" and its aim is to provide one which shall be capable of ready adjustment in a manner to clearly and in a sense instantly present to the mind of the user the result of various arithmetic problems required by the user, and one which shall possess advantages over prior analogous devices.

OIL-CAN.—W. J. DONNELLEY, Victor, Col. This hand oil-can is adapted to the use of machinists and others, and the object of the improvement is to provide such a can as may be readily carried in the pocket and one that is automatically sealed when not in use. It is particularly adapted for using heavy oils.

CYLINDER AND PISTON PACKING.—J. E. DOUGLAS, Birmingham, and G. W. HAYS, Avondale, Ala. The invention provides improvements in the packing of cylinders and pistons. The object is the provision of a simple, economical, durable, and effective packing which can be conveniently applied to pistons in course of construction and to those already in use. It may be used on solid or skeleton pistons or with followers.

COMB.—T. DOUGLAS, New York, N. Y. The object of this invention which relates to improvements in toilet or hair combs, is to provide a comb of simple and inexpensive construction having a liquid holder and distributer, so that while in use water, hair-dye, hair-tonic, or other liquid may be applied to the hair.

WASHING-MACHINE.—G. H. RHODES, Healdsburg, Cal. A peculiar form of drum is employed in this improvement. It is suspended to rock or turn on a transverse axis and the configuration of the drum is designed for throwing the fabrics from one side to the other of the drum and for causing portions of the fabrics which do not come in contact with the drum surfaces to frictionally rub against each other during oscillation of the drum, whereby all portions are cleaned without injury.

TRICK TOY.—J. R. ARMSTRONG, Pittsburg, Pa. The purpose claimed in this trick apparatus is to provide a toy adapted to illustrate the coining of money from blanks and to so construct the device that repeated operations may be successfully performed whereby to seemingly strike up a number of coins from a number of blanks.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 4203.—For makers of safety oil lamps for railroad cars, which extinguish automatically in case of collision or accident.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4204.—For the manufacturers of the Shaw patent compression flange coupling.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 4205.—For castings and materials for building a one-half horse power dynamo.

Morgan Emery wheels. Box 517, Stroudsburg, Pa.

Inquiry No. 4206.—For addresses of miners and grinders of high-grade phosphate rock.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 4207.—For manufacturers of sun flower, castor and other vegetable oils.

Blowers and exhausters. Exeter Machine Works, Exeter, N. H.

Inquiry No. 4208.—For makers of peanut butter and meal.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 4209.—For makers of cordage and fabrics of sisal and other coarse vegetable fiber.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 4210.—For manufacturers of house-boats.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4211.—For moulders of rectangular glass battery jars for storage batteries.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4212.—For makers of spring steel ⅛ inch in width.

For Machine Tools of every description and for Experimental Work call upon Garvin's, 149 Varick, cor. Spring Streets, N. Y.

Inquiry No. 4213.—For makers of automatic electrical clocks for closing circuits, having 24 figures on dial.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4214.—For manufacturers of voltmeters and ammeters for battery circuits having a scale of 1 to 10 volts or more.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

Inquiry No. 4215.—For manufacturers of Home Savings Boxes.

FOR SALE.—Bound volumes Patent Office Gazettes, 1852 to 1897 inclusive, separate indexes. Make an offer. J. R. Powers, 53 State Street, Boston, Mass.

Inquiry No. 4216.—For manufacturers and inventors of vending machines.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4217.—For the inventor or manufacturers of a machine used for folding headache powders.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4218.—For blue prints of one horse power stationary engines.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4219.—For makers of toy savings banks with musical attachment.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $5. Munn & Co., publishers. 361 Broadway, N.Y.

Inquiry No. 4220.—For parties who make or handle the Automatic Electric Advertisers, exhibited at the Pan-American.

FOR SALE.—Two patents. One good to handle by shop rights; one a useful household novelty for agents, mail order or regular trade. Chas. B. Post, New London, Ohio.

Inquiry No. 4221.—For a machine for planing and sanding hardwood floors.

PATENT FOR SALE—Entire right to U. S. and Canada. Automatic screw-holding attachment for screw-drivers. Simple, compact, inexpensive. John A. Yates, Rockport, Ind.

Inquiry No. 4222.—For manufacturers of agricultural and horticultural machinery.

Manufacturers desired for the manufacture under royalty of valuable U. S. air compressor patents. Invention great success and growing rapidly into large use abroad. Principals only dealt with. Full particulars on application to Box 722, c. o. Judd's, 5 Queen Victoria Street, London, England.

Inquiry No. 4223.—For machinery for manufacturing aluminium.

An attorney, having successfully practiced law in Chicago for fifteen years, but who finds the work too confining, wishes to quit the profession and to associate himself with some other business, in Chicago or elsewhere, wherein energy and activity are needed, and where his experience will be useful. If interview is desired please address Attorney, 1009, New York Life Building, Chicago, Ill.

Inquiry No. 4224.—For firms who fit up dock yards for government work.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 4225.—For dealers in numbers and letters for placing on houses and streets.

Inquiry No. 4226.—For makers of portable machine saws for felling trees.

Inquiry No. 4227.—For the manufacturers of a gasoline or kerosene engine called the Abenique.

Inquiry No. 4228.—For manufacturers and inventors of vending machines.

Inquiry No. 4229.—For dealers in powerful and first-class telephone transmitters and receivers.

Inquiry No. 4230.—For makers of filtering tubes for water.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

May 19, 1903,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

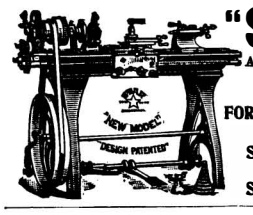
Adding machine, A. D. Gilpin 728,223
Advertising apparatus, W. C. Day 728,446
Agricultural implement, W. W. Brady 728,535
Air in factories, workrooms, etc., moistening, cooling, or heating the, L. Sconfietti 728,772
Air or other gases, mechanism for compressing, W. H. Reynolds 728,413
Air separator, C. H. Lane ..... 728,473 to 728,475
Albumose, making, D. Finkler 728,385
Alkaline sulfates, making dry, S. Trivick 728,335
Anchor, guy, L. D. Pitcher 728,609
Anchor, sea, J. Temperley et al 728,330
Arc light, electrolytic, W. T. Dean 728,210
Arc light system, regulator for alternating series, J. H. Hallberg 728,570
Artist's holding and separating clamp, G. C. Everett 728,450
Atomizer, C. A. Tatum 728,328
Axle box, vehicle, J. McFarland 728,597
Axle, revolving, Wm. F. Bangs 728,352
Baling press, Reese & Blount 728,760
Baling press indicator, P. & L. Trabue 728,515
Baling press tension band, P. & L. Trabue 728,516
Ball, H. M. Singer 728,311
Ball and socket knuckle, S. A. Schellenger 728,419
Bandage, chest, J. Baldwin 728,434
Battery. See Storage battery.
Battery plates, making, J. Bijur 728,189
Bearing, laterally adjustable side, G. W. Greenwood 728,224
Bed, T. L. Mahoney 728,483
Bed bottom, A. E. Beall 728,438
Bed clothes holder, S. A. Coffman 728,204
Belt and drawers supporter, C. Winkler 728,530
Belt supporter, G. T. Rhoads 728,414
Blast furnace, O. S. Garretson 728,700
Blower, powder, H. E. Krupke 728,247
Bluing, spool, A. K. Phillips 728,608
Boiler cleaning compound, J. D. & H. P. Scott 728,627
Bolster, T. Mitchell 728,270
Bonbons, etc., packing for, H. Finne, Jr. 728,386
Book holder, order, C. S. Binner 728,662
Bookkeeping register, E. Schumacher 728,625
Boot or shoe, L. A. Daniels 728,679
Boot or shoe holder, A. H. Baker 728,533
Bottle attachment, W. J. Lowenstein 728,735
Bottle, non-refillable, Jones & Wagner 728,241
Bottle, non-reusable, C. H. Spinney, 2d 728,319
Bottle stopper rubber disk attacher, Alcorn & Chatfield 728,351
Bottle washing machine, A. B. Park 728,754
Bottling and corking machine, F. O. Jessam 728,396
Box cover, sectional, T. H. Brady 728,195
Boxes or other receptacles, corner stay for, G. W. Dyarman 728,688
Bracket or belt, automatically adjustable, F. Mason 728,741
Brake mechanism, fluid, J. F. Mallinckrodt 728,485
Branding apparatus, A. Hayes 728,710
Brewers' hose, machine for cleaning, E. Pehl 728,2
Briquet, A. W. Chase 728,369
Bromin, recovering, C. D. Grove 728,566
Brush and mop and wringer therefor, combined scrub, R. H. Thomas 728,332
Brush holder, H. Geisenhoner 728,222
Brush holder, E. W. Mix 728,273
Brush holder, H. Geisenhoner 728,565
Brush holder, equalizing, E. J. Murphy 728,596
Buckle, W. F. Crafts 728,206
Buckle, belt, B. Wilentshik 728,641
Buffer, Lovely & Batcheder 728,480
Building, semipermanent portable, J. Kulhanek 728,471
Bundle carrier, E. A. Peck 728,408
Bunsen burner, A. B. Redell 728,296
Burnishing machine, J. G. Schneider 728,503
Cage and cable releasing device, R. LeRoy 728,588
Cake cooler, A. T. Mayo 728,742
Camera, W. K. L. Dickson 728,584
Candle extinguisher, R. v. Todenwarth 728,427
Car adjustable housing, J. A. de Macedo 728,736
Car brake safety attachment, L. S. Barber 728,654
Car construction, G. I. King 728,800
Car door bearing, C. Beatty 728,657
Car door, grain, Church & O'Gorman 728,203
Car draft rigging, railway, E. W. Hartough 728,227
Car dump, F. S. Ingoldsby 728,467
Car, dumping, A. J. Twiggs 728,635
Car bolster, railway, Lombard & Bowlind 728,479
Car gate opener, railway, F. Weimar 728,639
Car loader, E. H. Reynolds 728,288
Car mover, A. J. Maine 728,484
Car, railway, Wellman & Street 728,813
Car replacer, Care & Phillips 728,541
Car roping iron, railway, U. S. Drayer 728,212
Car seat, L. Janson 728,238
Car side bearing, H. M. Perry 728,757
Car tandem spring draft rigging, railway, C. F. Street 728,781
Car wheels, apparatus for hardening threads of, T. Mitchell 728,272
Car wheels, hardening tread of cast steel, T. Mitchell 728,271
Cars, automatic life guard or fender for tram, W. T. Watson 728,636
Cars, automatic wheel guard for tram, W. T. Watson 728,637
Carbureter, J. T. Wood 728,644
Carbureter muffler or silencer, I. E. Butler 728,200
Carbureter retort, J. T. Wood 728,645
Carpet fastener, J. R. Russell 728,767
Carrier. See Bundle carrier.
Carrier, McGehee & Lathwesen 728,403
Carrier apparatus, suspension, J. Record 728,294
Carton, McGehee & Brower 728,404
Casting with hardened portions and making same, H. W. Falk 728,217
Catamenial napkin, T. C. Asplund 728,432
Centrifugal machine, J. W. Macfarlane 728,737
Checks, record attachment for waiters' or merchandise, A. Wyse 728,649
Chromium compound and alkalies, production of, H. Specketer 728,779
Chuck, drill, K. O. Muehlberg 728,276
Chuck, fluid pressure operated, B. M. W. Hanson 728,458, 728,572
Churn, L. C. Martin 728,262
Cigar tip cutter, S. Y. Tabb 728,425
Circuit breaker, R. H. Read 728,293
Circuit breaker or switch for high potentials, E. M. Hewlett 728,797
Circuit making and breaking device, A. J. Wurts 728,820
Classifier, hydraulic, C. W. Merrill 728,847
Closet ventilation, J. J. Donovan 728,448
Clothes line, A. L. Richard 728,761
Clutch, W. F. Jaenecke 728,720
Clutch, friction, G. W. Ruth 728,622
Clutch operating mechanism, E. Turney 728,521
Coaster brake, back pedaling, J. Redding 728,295
Coat, J. G. Weimer 728,640
Cock operating mechanism, drain, H. W. McCombs 728,491
Cock repair spindle, E. J. Gallagher 728,699
Cock, water gage, J. C. Jensen 728,722
Coffer dam and caisson, combined, W. T. Pool 728,497
Coke conveyor, hot, M. Graham 728,390
Collapsible box, L. A. McCord 728,749
Collapsible box or crate, C. Richter 728,617
Colter and plow, H. J. Hughes 728,236
Combers, etc., cam race pin for cotton, A. C. Arey, Jr. 728,431
Concentrating apparatus, A. Ten Winkel 728,331
Condenser, C. F. Splitdorf 728,780
Contact breaker, C. F. Splitdorf 728,632
Controller handle lock, J. B. Linn 728,590
Conveyor, M. C. Schwab 728,626
Conveyor for separators, etc., cross, S. B. Hart 728,460
Corborundum and alumina, treating kaolin for production of, F. C. Weber 728,528
Cover of rhombic or lens-shaped section, instrument, W. Sabel 728,500
Cork puller, H. Tscherning ..... 728,517 to 728,520
Cork puller, R. H. Wiles 728,642
Cork puller, C. Morgan 728,806
Corn popping apparatus, C. Cretors 728,550
Corn husking device, P. A. Waller 728,429
Corn sheller, A. H. & H. A. Berns 728,661
Corset busks, means for securing, R. Scales 728,305
Counter, W. L. Sandage 728,502
Coupling. See Hose coupling.
Cover, receptacle, F. O. Soderstrom 728,318
Crane, overhead traveling, H. A. Otto 728,495
Cream cooler and aerator, F. O. Hague 728,392
Crossbow, H. Schramm 728,504
Cuff holder, W. T. Robinson 728,415
Cultivator cotton chopping attachment, C. W. McMillan 728,405
Cultivator, two-row disk, A. Holtz 728,798
Curb and gutter, combined, W. H. Ferguson 728,693
Curler, hair, J. D. Smith 728,422
Current collector, E. D. Priest 728,614
Current machines, starting alternating, J. E. Woodbridge 728,817
Curtain attachment, window, O. A. Essig 728,216
Curtain fixture, B. Kuchborth 728,585
Cut-off water conductor, S. D. Noel 728,281
Cycle crank, dead point position, device for overcoming, E. Johow 728,240
Dental cuspidor, H. E. Weber 728,638
Dental manikin, E. P. Wright 728,818
Dental plate, S. G. Supplee 728,633
Dental vulcanizer, C. A. Davis 728,375
Derailer, G. L. Mansfield 728,740
Diffusion apparatus, E. H. Schofield 728,308
Disinfecting apparatus, E. Fournier 728,220, 728,221
Display rack, Feldmann & Haas 728,219
Distilling petroleum, apparatus for continuously, M. Livingston 728,257
Dresser, J. L. Larson 728,586
Drill press gearing, H. Dreses 728,213
Duplicating device, manifold, H. H. Norrington 728,601
Dye and making same, azo, E. A. Fourneaux 728,388, 728,455
Dye and making same, blue sulfur, Schmidt & Bethmann 728,623
Dye, blue disazo, A. L. Laska 728,477
Ear pump, J. B. Wantz 728,326
Easel, R. T. Anthony 728,653
Electric distribution system, C. W. Stone 728,325
Electric elevator, F. B. Rae 728,292
Electric machine brush, dynamo, W. D. Litchfield 728,256
Electric machine system, dynamo, F. H. Jeannin 728,579
Electric meter prepayment attachment, Arnold & Brown 728,531
Electric motor actuating and controlling device, O. C. Britsch 728,537
Electric motors, device for automatically cutting out starting resistances of, G. H. Whittingham 728,814
Electric resistance structure, Geisenhoner & Van Aller 728,564
Electric regulator, E. W. Rice, Jr. 728,300
Electrical distribution, S. L. Naphtaly et al 728,752
Electrical distribution system, A. D. Lunt 728,259
Electrical distribution system, C. P. Steinmetz 728,321, 728,322
Electrical distribution system, E. W. Rice, Jr. 728,299
Electrical machines and appliances, winding of, R. Ronge 728,766
Electrolytic cell, H. K. Moore 728,274
Elevator apparatus, I. H. Venn 728,338
Elevator controlling mechanism, T. W. Heermans 728,228
Elevator guard, Fisk & Spencer 728,453
Embroidering machine, R. Cornely 728,370
Engine, Officer & Mercer 728,283
Engine and power transmitting means therefor, P. Murray 728,807
Engine electric igniter, hydrocarbon, H. M. McCall 728,747
Engine lubricator, steam, G. C. Full 728,698
Engine regulating device, internal combustion, F. Reichenbach 728,297
Engines, apparatus for preventing the racing of marine, E. Hope 728,576
Engraving machine, W. S. Eaton 728,556
Evaporating apparatus, H. Howard 728,395
Excavator and vending machine, Grant & Shears 728,391
Exhibiting and vending machine, A. E. Bennett 728,534
Exhibition apparatus, F. W. Kremer 728,246
Extractor. See Stump extractor.
Eyelet, G. E. McCormack, reissue 12,111
Feed water heating system for multiple expansion engines, B. V. Nordberg 728,282
Feeder apparatus, boiler, J. M. Williams 728,348
Feeder, automatic poultry, L. J. Davis 728,378
Felt, fabric, or the like, stretcher for, E. Dedicke 728,682
Fence wire stretcher, C. W. Hoagland 728,393
Films, adapter for containing a flat package of, Hutchings & Robertson 728,719
Fire extinguisher, automatic, R. W. Newton 728,280
Firearm, automatic, F. R. von Mannlicher 728,739
Firearm, barrel lock, E. Sturgill 728,326
Firearm, safety sear, R. Bloomer 728,791
Fire place heater, T. B. Bayless 728,355
Fireproof wood, etc., and making same, J. L. Ferrell 728,452
Fishing float, H. J. Cook 728,674
Fishing reel, R. L. Hunter 728,717
Fishing spoon, C. F. Breidenstein 728,360
Floor surfacer, cleaner, and polisher, A. T. Spence et al 728,423
Folding chair, combination, Flannery & Plunkett 728,454
Fuel from brea, manufacture of artificial, J. T. Davis 728,680
Furnace, Railton & Campbell 728,411
Furnace, P. B. Harrison 728,459
Furnace bottom, J. Huxley 728,578
Furnaces, device for continuously tapping pig-iron from blast, A. von Kerpely 728,727
Furnaces, pipe stove for heating the blast for blast, E. P. Davis 728,377
Gage, C. E. Eldridge 728,558
Galley lock, A. C. Ladd 728,729
Game apparatus, C. O. Sobinski 728,317
Game apparatus, C. Tanron 728,327
Game table, Patton & Hochwalt 728,756
Game of table or parlor cricket, E. M. Amphlett 728,187
Garment fastening or other holding device, J. F. J. Gunning 728,796
Garment hanger, F. P. Johnson 728,239
Gas burner lighting device, incandescent, J. and G. Keith 728,242
Gas generator, acetylene, Hunt & Baughman 728,237
Gas pressure reducing apparatus, A. R. Bullock 728,361
Gas regulating burner, C. W. Taylor 728,783
Gases, subjecting materials to the action of air or other, C. E. Mark 728,261
Gate, G. Ogden 728,603
Gate attachment, O. U. Peterson 728,288
Gearing, frictional, J. Kynoch 728,400
Gelatin, making, W. Cormack 728,205
Glass cutting apparatus, H. J. Sage 728,417
Gold extracting process, T. B. Joseph 728,397
Governor, H. M. McCall 728,748
Governor, engine, J. Hardill 728,707
Gowns, guide for the design of ladies', A. B. Rheinheimer 728,498
Grain drill, A. N. Norris 728,492
Grain elevator, J. B. Schuman 728,771
Grating, cell, P. H. Gorman 728,456
Grave cope, E. B. Blood 728,191
Grinding mill cleaner, H. D. Phillips 728,289
Gun barrel protector, B. Robbins 728,302
Gun sight, Hubbard & Vestal 728,716
Harrow, W. S. Ross 728,304
Harrow tooth fastener, W. D. Whitney 728,347
Harvester attachment, L. Franzmeier 728,561
Harvester frame raising or lowering device, E. W. Burgess 728,199
Haulage clip, J. W. Smallman 728,421
Hay rakes or other implements, self-fastening spring tooth for, J. Macphail 728,592

(Continued on page 419)

© 1903 SCIENTIFIC AMERICAN, INC.

Heater, O. F. Roggenkamp 728,618
Heel plate, C. E. McKenna 728,751
Heel trimming machine upper guard, E. Villeneuve 728,786
Hoist circuit breaker, S. S. Wales 728,523
Hoisting and conveying cableway, B. H. Hardaway 728,574
Hood, protective, E. Langer 728,476
Hook. See Skirt hook.
Hook and eye, M. H. Eiseman 728,557
Hook and eye, J. F. Schoeppl 728,770
Horseshoe, P. Wilburg 728,815
Horseshoe, nailless, J. Surfass 728,773
Hose coupling, Frankenberg & Miller 728,696
Hub, interchangeable, E. C. Davis 728,376
Hunting knife, M. H. Rowland 728,416
Hydraulic press, C. Seymour 728,628
Hydrocarbon burner, B. N. Hawes, reissue 12,114
Hydrocarbon burner, W. De Latimer 728,683
Ice cutter, J. Ducharme 728,555
Image projecting device, E. M. Barnes 728,655
Incrustation preventive, T. G. Lockwood 728,258
Indexing apparatus, B. M. W. Hanson 728,457
Indexing apparatus, fluid pressure operated, B. M. W. Hanson 728,573
Inflammable liquids, safety device for vessels containing, V. Posno 728,610
Ingot mold, T. Dixon 728,552
Inkstand, C. Colombani 728,545
Innersole cement machine, G. F. Dunn 728,793
Insulator, F. M. Locke 728,805
Insulator, electrical, E. J. Burke 728,442
Internal combustion engine, R. D. Chandler 728,543
Internal combustion engine, J. H. Jones 728,724
Ironing board, A. C. Schatz 728,306
Japanning small articles, machine for, T. A. Perrins 728,606
Joint casing, universal, C. W. Spicer 728,779
Journal box, F. H. Crafts 728,547
Journal lubricator, J. G. Smith 728,777
Knitting machine, L. C. Huse 728,465
Knockdown bracket, H. G. Voight 728,339
Ladder and window jack, combined extension step, A. W. Young 728,670
Laminated lever switch, Hewlett & Badeau 728,231
Lamp, B. Nadeau 728,599
Lamp chimney holder, G. W. Blair 728,663
Lamp, electric, A. J. Wurts 728,648
Lamp, electric headlight, H. P. Wellman .. 728,789
Lamp, gas or vapor, A. Mende 728,265
Lamp glowers, apparatus for applying terminal wires to electric, J. M. Gulentz. 728,567
Lamp glowers, applying terminal wires to electric, J. M. Gulentz 728,568
Lamp heater cut-out, electric, A. J. Wurts, 728,647, 728,821
Lamp, incandescent vapor, J. B. Christian. 728,672
Lamp, oil, M. & H. Romans 728,765
Lamp, vapor, A. J. Simpson, Jr 728,509
Lantern, G. W. Manley 728,738
Latch and door, electrically operated, J. Chambers, Jr 728,367
Lathe change gearing, A. E. Newton 728,279
Lathe taper attachment, Kington & Ellis .. 728,398
Leather, stirrup, J. P. Wroe 728,819
Life preserver, W. N. Morrison 728,745
Life saving appliance, C. J. Dampf 728,208
Lift cutting and heel building apparatus, D. M. Beck 728,658
Ligature receptacle, aseptic, H. L. Cox ... 728,444
Lineman's implement, S. Kirlin 728,728
Link-forming machine, A. S. Standish 728,320
Linoleum or like coated fabrics, composition for use in manufacture of, J. A. Shepherd 728,507
Liquid fuel burner, Beck & Dior 728,356
Lock and latch, combined, M. C. Patrick .. 728,755
Loom shuttle, H. Cote 728,371
Loom shuttle, self-threading, G. Fair, 728,383, 728,384
Loom shuttle, weavers', E. G. Ferreira 728,694
Magneto generator, G. E. Wheeler 728,343
Mail box, W. B. Barnes 728,353
Mail box, S. S. Langford 728,401
Mailing tube, L. Patterson 728,407
Mailing wrapper, L. E. Barnes 728,435
Malt, grain, seeds, etc., apparatus for cleaning, O. G. C. L. J. Overbeck 728,604
Manager's reference system, H. H. Mayberry 728,593
Manifold sheet, H. M. Hay 728,461
Manifolding device, J. O. Deckert et al 728,681
Mat. See Metallic mat.
Match box, C. J. Ulbricht 728,522
Mattress, C. B. Meeker 728,594
Maximum demand indicator, F. P. Cox 728,546
Measuring instrument, W. L. West 728,790
Measuring instruments, means for compensating temperature changes in electrical, W. H. Pratt 728,612
Measuring machine, self-registering cloth, W. M. Thompson 728,333
Meat chopper geared driving attachment, E. C. Pollard 728,409
Mechanical movement, R. F. Hargraves ... 728,226
Memory jogger, A. G. Blincoe 728,358
Metal structure, expanded, H. E. White 728,345
Metal wheels, making, G. W. Packer 728,285
Metallic mat, G. W. Walters 728,525
Metals, means for precipitating dissolved, P. W. McCaffrey 728,746
Microtome, Bausch & Hommel 728,656
Milk aerator, J. A. Trentlage 728,334
Motor control system, F. E. Case 728,540
Motor control system, W. B. Potter 728,611
Motor with rotating piston, G. Silvestri ... 728,630
Mowing machine, E. A. Johnston 728,580
Mowing machine attachment, W. Hord 728,233
Mucilage or paste pot, J. Maine 728,260
Music box, W. A. Drysdale 728,449
Musical instrument, stringed, J. Lindstrom. 728,255
Necktie fastener, C. A. G. Knoll 728,801
Numbering machine, T. H. Boss 728,194
Nut finishing machine, G. Dunham 728,214
Nut lock, J. C. Foster 728,560
Nut lock, C. C. Border 728,665
Nut locking washer, L. T. Stephenson 728,323
Oil can, J. A. Baeuerle 728,433
Ore washing pan, J. A. Creasy 728,677
Organ octave coupler, reed, S. Jenkinson 728,721
Ornamental ring, L. E. Sadler 728,501
Outdoor seat, Dawson & Sunderland 728,209
Paddle wheel, J. Rourke 728,620
Paint spraying apparatus, R. W. Bird 728,439
Paper folding machine, W. F. Liddle 728,733
Paraffin fabric, C. C. Hoyt 728,234
Pea hulling machine, Pillmore & Anderegg. 728,759
Perambulator, G. D. Leadbetter 728,253
Photocopying machine, P. Latta 728,730
Photographic developing apparatus, J. W. Meek 728,743
Photographic film package, flat form, Hutchings & Robertson 728,718
Photographic plate developing apparatus, L. Brown 728,538
Photographic printing, Shepherd & Bartlett 728,310
Photographic purposes, copying material for, R. Krayn 728,245
Piano action bracket, E. Bornhoeft 728,192
Piano action, upright, E. Bornhoeft 728,193
Picture holder, Etherton & Powell 728,559
Pie machine, H. H. Jones 728,799
Pipe protector, sanitary, T. Lovely 728,734
Plant cover, J. L. Larson 728,250
Planter, combined seed, P. Le Sueur 728,803
Planter, corn, H. D. Smith 728,510
Planter, seed, J. H. Bedingfield 728,660
Plow, L. A. Weyburn 728,341
Plow, E. P. Currey 728,445
Plow disk jointer, T. L. Bolser 728,359
Pole changer, J. Crawford 728,372
Pool table rack and tally, G. F. Goss 728,706
Potatoes, composition for bleaching, A. Danmar 728,374
Printing machine for printing yarns, etc., automatic color, O. Hallensleben 728,225
Printing press motor bracket, F. E. Rich .. 728,301
Printing presses, apparatus for cleaning, drying, and polishing inking rollers of, V. Bauer 728,354
Printing presses, registering wood base cuts on, E. J. Jones 728,723
Puller. See Cork puller.
Pulley or wheel, friction, W. D. Huse ... 728,466
Pulp, etc., apparatus for straining paper, J. White 728,346
Pulp, manufacturing perforated sheets of wood, G. S. Lindberg 728,804
Pump handle bearer, T. E. Long 728,402
Pump operating device, air, R. D. Albright 728,651
Punch, check, W. J. Kenderdine 728,726
Purifying apparatus, P. J. Boucher 728,440
Puzzle, B. G. Lamme 728,249
Quilting frame, cot, and ironing board holder, combined, F. G. Dieterich 728,684
Rail joint, K. Kohn 728,469
Rail joint bed plate, J. R. Bitner 728,190
Railway, elevated electric, W. Varzar 728,428
Railway jack, wheel clamp, A. L. Casebeer. 728,365
Railway rail joint, Brewer & Archer 728,196
Railway rail joint, G. E. Daggett 728,373
Railway rails upon wooden ties, fastening, I. Copeland 728,675
Railway signal, J. D. Price, reissue 12,113
Railway switch, A. H. Vandling 728,635
Railway switch operating mechanism, J. E. Ruby 728,621
Railway, third rail electric, S. B. Stewart, Jr. 728,324
Railway track rails, device for preventing the spreading of, C. A. Alkins 728,186
Railways or tramways, permanent way of, A. Ambert 728,652
Reaper or mower attachment, J. F. Sickenberger 728,629
Reclining chair, O. J. Mattax 728,264
Rectifier, W. Stanley 728,812
Refrigerating means, George & Rademacher 728,702
Reservoir construction, P. Evans 728,691
Retort discharging apparatus, M. Graham ... 728,389
Revolving bodies, instrument for locating over-balance in, O. Snell 728,315
Riveting brace, J. L. Pearson 728,605
Road roller, Fawcett & Heisler 728,451
Roasting apparatus, C. Cretors 728,549
Rock drill, hand, V. Y. Smith 728,314
Rolling and trimming machine, J. Ditson ... 728,379
Rolling blanks for I-beams or girders, R. D. York 728,349
Rolling mill pinion housing, O. N. Rauschenberg 728,615
Rolling mills, shafts, etc., automatic controller for, C. Kuhlewind 728,802
Rope, B. Kirsch 728,399
Rotary engine, M. J. Hewlett 728,232
Rotary engine, Masterman & Magney 728,263

(Continued on page 420.)



"Star" Foot and Power Screw Cutting Automatic Cross Feed Lathes

FOR FINE, ACCURATE WORK

Send for Catalogue B.

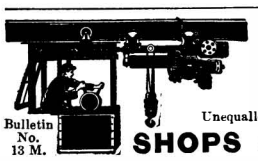
SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N. Y., U. S. A.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Wire Cloth, Wire Lath, Electrically-Welded Wire Fabrics and Perforated Metal of all Kinds

Manufactured by

CLINTON WIRE CLOTH COMPANY, CLINTON, MASS.
BOSTON NEW YORK CHICAGO SAN FRANCISCO



TRAVELING ELECTRIC HOISTS

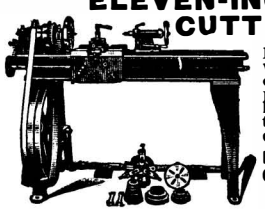
Unequalled in Light Conveying in

SHOPS AND YARDS

Bulletin No. 13 M.

PAWLING & HARNISCHFEGER
162 Clinton St., Milwaukee, Wis.

B. F. BARNES ELEVEN-INCH SCREW CUTTING LATHE



For foot or power as wanted. Has power cross feed and compound rest. A strictly high grade, modern tool. Ask us for printed matter.

B. F. BARNES COMPANY,
Rockford, Ill

MONOPLEX INTERCOMMUNICATING TELEPHONE $4.00 each

The simplest and most reliable instrument now on the market. Absolutely guaranteed for one year. Diagrams and directions are plain and anybody can install them. Send for circular describing the three systems and the advantage of our instruments.

Price, 7 Station Instruments, $4.00 each
Price, 11 Station Instruments, 4.50 each
Price, 2 End Instruments, 2.50 each

ATWATER KENT MFG. WORKS,
110 N. 6th St., Philadelphia, Pa.

THE TURNER BRASS WORKS
57 MICHIGAN ST., CHICAGO.
ALUMINUM, BRASS AND BRONZE CASTINGS MACHINING, STAMPING, SPINNING, POLISHING, PLATING.
ESTIMATES FURNISHED ON SPECIAL WORK.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, New York
Branch Office, 625 F St., Washington D. C.

CRAMER

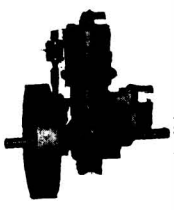
Crown Plates are more rapid than any other plate in the market With this plate clear quick printing Negatives can be secured

These plates are especially adapted for Tourists using Hand-Cameras

G. CRAMER DRY PLATE CO.
ST. LOUIS, MO.

Offices in
New York: 32 East 10th Street
Chicago: 1211 Masonic Temple
San Francisco: 819 Market Street

POWER AIR PUMP FOR STEAM CARRIAGES
ADDRESS MALTBY
No 11 CLINTON ST. BROOKLYN. N.Y.



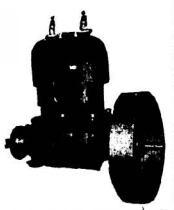
New Type 2-Cycle Motor

PATENTED.

Range of Speed, 200 to 2,000 Revolutions.
4 H. P., Auto. or Marine, 100 lbs.
8 H. P., Auto. or Marine, 175 lbs.
Manufacturers in search of the best should address

CUSHMAN MOTOR CO.,
Lincoln, Nebraska.

Gasoline Motors



For AUTOMOBILES and LAUNCHES

Can make prompt delivery Catalogue on application

LACKAWANNA MOTOR COMPANY
1448 to 1452 Niagara St.
BUFFALO, N. Y.

OUR AUTOMOBILE SPRAY BURNER

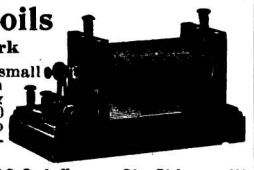
For Crude Oil, Kerosene or Gasoline. Does not vaporize, but atomizes the oil. Plenty of fire. Only 10 pounds pressure.
Price $80.00 C. O. D.
Burners for furnaces of every description.
Write for Catalogue No. 4 and Testimonials.

Our Range Burner for Kerosene or Gasoline. Adaptable to any range or stove. Blue flame. No smoke. No smell.
Price $10 C. O. D.

The National Oil Burner & Equipment Co., St. Louis, Mo.

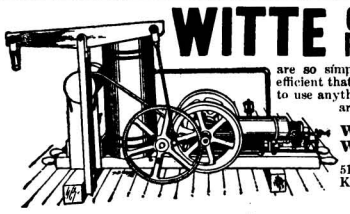
Induction Coils

¼ to 18-in. Spark



Cut shows type of small coil ¼, ⅜, ½, ⅝, ¾, 1 inch sizes, with pole changing switches. Coils giving 20 to 60-in. spark made to order. Price list on application.

C. H. Thordarson, 153-159 S. Jefferson St., Chicago, Ill



WITTE Gasoline Pumpers

are so simple, durable and efficient that it does not pay to use anything else. They are always ready.

Witte Iron Works Co.,
517 West 5th St.,
Kansas City, Mo.
Cat. E.

It Fits the Case

Half the value of an accurate watch movement, like this one, might be lost in a poorly made, pretended gold case. That is why we make *complete* watches; honest cases, fitted to fine movements; both made in our mammoth factory—largest in the world.

"Accurate-to-the-Second"

Dueber-Hampden Watches

bear copyrighted names, engraved on the works, and our gold cases have stamped on the inside:

DUEBER 18 K — Our Trade Marks — 14 K DUEBER

Send for free book, "The Care of a Watch," it will give you important information, and tell you what to ask your dealer for.

DUEBER-HAMPDEN WATCH WORKS,
56 South St., Canton, O.

Rider Agents Wanted

in each town to take orders for our new High Grade Guaranteed Bicycles.

New 1903 Models

"Bellise," complete $8.75
"Cossack," Guaranteed High Grade $10.75
"Siberian," a beauty $12.75
"Neudorf," Road Racer $14.75

no better bicycle at any price.

Any other make or model you want at one-third usual price. Choice of any standard tires and best equipment on all our bicycles. *Strongest guarantee.*

We SHIP ON APPROVAL C. O. D. to any one *without a cent deposit* and allow 10 DAYS FREE TRIAL before purchase is binding.

500 Good 2nd-hand Wheels $3 to $8.

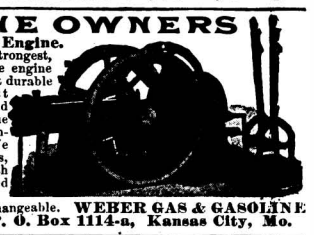
DO NOT BUY a bicycle until you have written for our free catalog with large photographic engravings and full descriptions.

MEAD CYCLE CO. Dept. 59-C, Chicago.

TO MINE OWNERS

You need a Hoisting Engine.

You want the best, strongest, safest, most up-to-date engine that is made—the most durable and yet the greatest saver of money. Send for our free catalogue and state the size of engine you want. We build them for mines, quarries and docks. Both friction and geared hoist, 6 to 150 H. P.



All parts easily interchangeable. WEBER GAS & GASOLINE ENGINE CO., P. O. Box 1114-a, Kansas City, Mo.

Have Electric Lights IN YOUR LAUNCH

You can if you use the "CHAMPION ACCUMULATORS"

Charging the battery from any good ignition Dynamo. Using battery for starting engine, emergency and running the lights.

Send for booklet.

H. C. MacRAE,
315 St. Paul St., Baltimore, Md.

CADILLAC Automobile

1903 $750

The Cadillac Runabout at $750 is the greatest value ever offered in the history of motor cars. No other machine is so strongly built, or has either engine, transmission gear or steering mechanism worthy of comparison except those costing about three times as much. Great speed on the level; wonderful hill climber—the automobile that solves the problem of safe, rapid and pleasant motor travel. Buggy top at $30 extra; tonneau, providing seats for two more—*facing forward*—$100 extra. Illustrated booklet N sent free.

CADILLAC AUTOMOBILE COMPANY, Detroit, Mich.

© 1903 SCIENTIFIC AMERICAN, INC.

The Chauffeur Sees

the improvement in speed and ease that comes when all automobile parts are lubricated with

Dixon's Automobile Graphites

Our Booklet W "*A Foot for Dixon's Graphite*," describes the uses of Dixon's No. 635 Flake Graphite, Dixon's Motor-Chain Compound, Dixon's Graphite Cup Greases, Dixon's Graphitoleo, and Dixon's Pipe-Joint Compound. Sold by dealers. *The booklet is Free.*

JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY, N. J.

Dr. Deimel (Linen-Mesh) Underwear

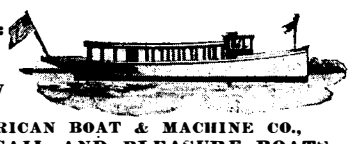
Discomfort and irritation are unknown to wearers of this underclothing. It is the greatest "dress reform" of the age.

Booklet telling all about them and the garments may be had

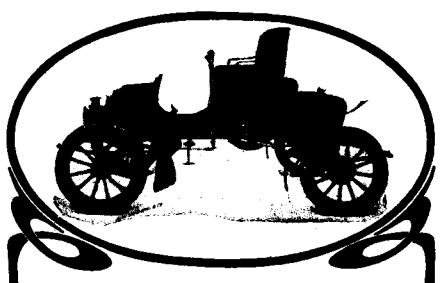
AT LEADING DEALERS EVERYWHERE

THE DEIMEL LINEN-MESH CO.,
(Originators of Linen-Mesh)
491 Broadway, New York.

Our Specialty: Knock-Down Boats of any description



AMERICAN BOAT & MACHINE CO.,
ROW, SAIL AND PLEASURE BOATS,
Marine Station. ST. LOUIS, MO.



BRAKE POWER

is the test of safety. Look carefully at the brake when you buy an auto.—power in the brake means everything in an emergency.

Rambler

Touring Cars

are fitted with an extra powerful brake of improved pattern that will stop the rig in its own length. In addition they have special emergency brakes fitted on the hub of each driving wheel.

That's another of the Rambler advantages—you'll find the rest of them stated in our handsome illustrated catalogue. Shall we send you a copy?

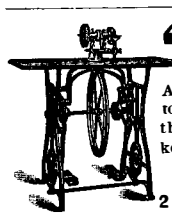
Thos. B. Jeffery & Co.
Kenosha, Wis., U. S. A.

For Present Time
For Future Time
For All Time

ELGIN TIME

Every Elgin Watch is fully guaranteed. All jewelers have Elgin Watches. "Timemakers and Timekeepers," an illustrated history of the watch, sent free upon request to

ELGIN NATIONAL WATCH CO., ELGIN, ILL.



"The Sharer"

A new foot power that can be applied to all light machinery. A kick starts the machine and an occasional kick keeps it going. *Send for our Booklet*

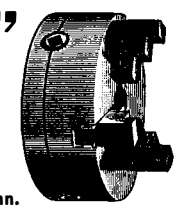
SLOTKIN & PRAGLIN,
210A Canal St., New York.

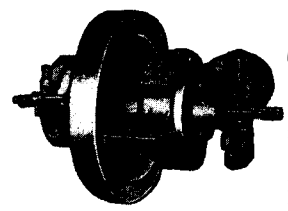
"CUSHMAN" CHUCKS

All styles and sizes.

Send for Catalogue.

THE CUSHMAN CHUCK CO.,
189 Allyn St., Hartford, Conn.





6 H. P. AUTOMOBILE MOTOR

complete with transmission and float feed carburettor.

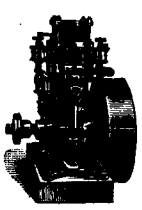
$185.00

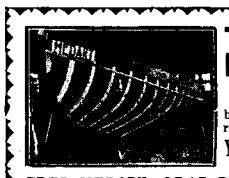
Pierce Engine Co.,
Racine, Wis.

THE INTERNATIONAL KEROSENE OIL ENGINE

is the most simple, compact and powerful ever constructed for practical purposes. Needs less attention, is less liable to get out of order and is cheaper to run than any engine manufactured. Simple, durable, economical and reliable. Nothing but ordinary Kerosene Oil required to run it. Safe and easily operated.

International Power Vehicle Co.,
STAMFORD, CONN.





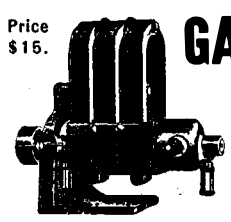
The MEDART BOAT BUILDING MATERIALS

bring boat construction within the range of amateurs, at a small cost.

Yachts, Launches, Row Boats.

Send stamp for catalog.

FRED MEDART, 3545 DeKalb St., St. Louis, Mo.



Price $15.

GAS ENGINE IGNITERS

for Marine, Stationary and Automobile engines. Will save their cost many times over in one year.

Write for circulars.

The Carlisle & Finch Co.,
233 E. Clifton Ave., Cincinnati, O

A HIGH MARK

is easily covered without the use of a scaffold, by

Patton's Aereo-Painter

By the use of compressed air, it enables one man to accomplish as much as five men with brushes, and saves its cost in two days' use. Weighs only twenty-five pounds, and has nothing to get out of order.

PATTON'S ASBESTOS FIRE-PROOF PAINT

gives effectual protection to inside woodwork liable to exposure to sparks or light flames. Reduces insurance rates. Best applied with the Aereo-Painter. Can be applied with brush. Full information and painted samples—FREE.

PITTSBURGH PLATE GLASS CO., General Distributers.
PATTON PAINT CO. 227 Lake Street, Milwaukee, Wis.

S&G "FORCE" DRY BATTERY.
POWERFUL & LASTING. 2.00 PER DOZ. BELL OUTFITS COMPLETE 75¢ EACH.—CATALOGUE—
BROADWAY BICYCLE CO.
7 WARREN ST. NEW YORK.

Howard Two and Four Cycle MARINE AND AUTOMOBILE MOTORS

Write for Cat.

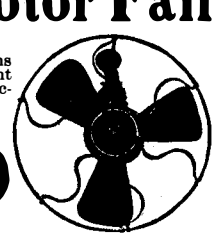
Grant Ferris Co.
Troy, N. Y.

TO KEEP COOL

you must have a whirling fan to drive the heated, impure air from your rooms. Will you pay $15 or more for an electric fan, or will you buy our famous

Water Motor Fan

which makes 2,000 revolutions a minute and throws a current of air as strong as does an electric fan yet costs only



$1.50

It can be attached to any spigot direct, or connected by rubber hose and attached to wall in same or another room. Can be adjusted by anyone—even a child—quickly and easily. The fan is ten inches in diameter. Requires but low pressure, the motor being fed through a 1-16-inch hole. Runs smoothly, without noise or annoyance—especially desirable for the sickroom. Cannot get out of order.

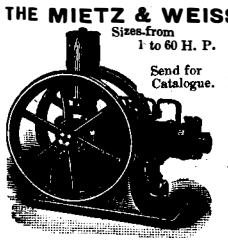
Price Complete $1.50 Booklet Free

Good Agents Wanted to sell the Water Motor Fan to the thousands who have been waiting for a perfect fan at a low price.

DELAWARE RUBBER CO., Dept. 107,
631 Market Street, Philadelphia, Pa.

CONTROL OF FIRE.—VALUABLE PAPER on fire extinguishment. SCIENTIFIC AMERICAN SUPPLEMENT 1134. Price 10 cents. For sale by Munn & Co. and all newsdealers.

THE MIETZ & WEISS KEROSENE and GAS ENGINE



Sizes from 1 to 60 H. P.

Send for Catalogue.

burns KEROSENE cheaper and safer than gasoline. Automatic, simple, reliable. No electric battery or flame used. Perfect regulation. Belted or directly coupled to dynmao for electric lighting, charging storage batteries, pumping and all power purposes.

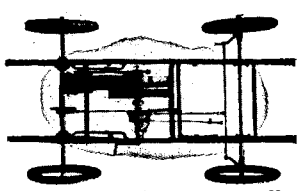
A. MIETZ,
128-138 Mott St., New York.

ADOPTED BY U. S. GOVERNMENT.

Highest Award, direct coupled Generator Set, Paris Exposition, 1900.

Gold Medal, Pan-American Exposition, 1901. Gold Medal, Charleston, S. C., Exposition, 1902.

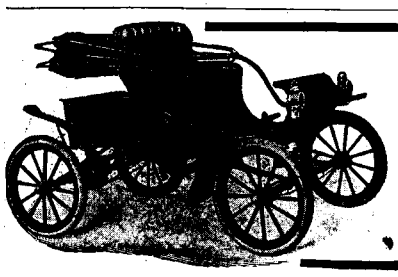
ROTARY PUMPS AND ENGINES. Their Origin and Development.—An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in SUPPLEMENTS 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co. and all newsdealers.



We manufacture gears and bodies suitable for all purposes. We also sell supplies and can furnish any part or all the parts for a gasoline or steam rig. See our late catalogue, FREE.

NEUSTADT-PERRY CO.,
926-830 S. 18th St., St. Louis, Mo.

CHAS. T. HOWE & Co., 51 Hudson St. New York, Export Agents.



LISTEN

to all the stories that are told about the various experimental cars now being placed on the market, then

BUY *The* Oldsmobile

on its successful record of 3 years' satisfactory service by over 8,000 riders. It is built to run and does it.

PRICE $650.

Write for Illustrated Book to Dept. 21.

OLDS MOTOR WORKS, - DETROIT, MICH.
Factories: DETROIT and LANSING.

Rotary engine, Breed & Hawn	728,536
Roundabout or pleasure railway, J. M. Taylor	728,514
Rubber tired wheel, R. Mulholland	728,490
Rule, lumber, J. F. W. Ritsch	728,763
Sad iron, A. J. Campbell	728,669
Safety stopper, I. Timar	728,426
Sash fastener, A. Carlson	728,670
Sash or sliding door attachment, window, P. McCabe	728,277
Saw filing gage, S. J. Galloway	728,562
Sawing machine, O. Nordberg	728,753
Scaffolding support, A. Menczarski	728,595
Scale, J. Hotsapillar	728,577
Scale, W. H. Sanderson	728,418
Scholar's companion, A. W. Trescott, reissue	12,112
Scrubbing device, floor, M. C. Bliss	728,664
Scrubbing machine, P. Cecil	728,542
Seat back, R. P. Elliott	728,215
Seed hulling and breaking machine, cotton, M. F. Williams	728,643
Sewing machine, hat, E. G. O'Donnell	728,602
Sewing machine slack thread take-up, J. Diehl	728,211
Sewing machine stop mechanism, D. Mills	728,262
Shade, collapsible sun or rain, L. Seeger	728,505
Shade roller cap, W. Bucholt	728,441
Shade trimming machine, window, Steffee & Beeney	728,424
Shafts, fastening device for connecting collars and, L. F. Fales	728,692
Shaper table support, S. G. Chambliss	728,368
Sheaf carrier, H. F. Crandall	728,676
Sheet drier, A. K. Taylor	728,329
Sheller. See Corn sheller.	
Shipping or traveling case, C. R. Walter	728,524
Shirt waist, W. H. Hamilton	728,571
Shocker, bundles, J. G. Hoffman	728,713
Shoe, C. C. Hoyt	728,235
Shoe heater, M. C. Gerard	728,703
Shoe horn, A. D. Washington	728,788
Shoe stamping machine, J. J. Heys	728,464
Sifting apparatus, E. Maag	728,482
Signal system, J. K. Reid	728,616
Signaling device, electric, G. E. Clark	728,544
Sign, illuminated, C. E. Lee	728,731
Sizing, G. A. Fredenburgh	728,697
Skeining machine, J. H. Shearn	728,775
Skirt gage, J. B. McFatrich	728,598
Skirt hook, J. A. Savage	728,769
Slack adjuster, automatic, F. L. Clark	728,443
Slag furnace, O. S. Garretson	728,794, 728,795
Sleigh knee, F. Kamke et al	728,725
Smelting, matte or pyritic, O. S. Garretson	728,701
Snow plow, F. A. Brigham	728,197
Sound or speech, diaphragm for machines for recording or reproducing, J. C. English	728,382
Sound record cylinders, apparatus for forming duplicate, A. N. Petit	728,607
Sounding apparatus, navigational, J. C. Dobbie	728,553
Speed mechanism, variable, A. Mill	728,266
Speed mechanism, variable, F. C. Miller	728,268
Speed regulator, spring motor, G. W. Merrill, Jr.	728,488
Spinning spindles, automatic filtering lubricator for the bushings of, J. L. Geis	728,563
Stacker, pneumatic, F. L. Stallard	728,511
Stamp mill stamps, hanging up or throwing out of operation, J. J. R. Smythe	728,631
Stamping press, J. J. Heys	728,463
Stanchion, cattle, H. Taylor	728,784
Starching machine, W. M. Barnes	728,436, 728,437
Starting machine, J. F. Carr	728,539
Steam boiler, C. Olson	728,284
Steam boiler, C. Cretors	728,548
Steam boiler, W. C. Lockwood	728,591
Steam engine, compound, J. Hardill	728,709
Stoker, mechanical, T. R. Butman	728,362
Stoker or feeder, automatic coal, Lichtenberger & Zimmermann	728,732
Stool and quilting frame, combined, J. Fitzgerald	728,695
Storage battery, A. W. Charlton	728,202
Storage battery, M. Emme	728,381
Storage battery, J. C. Brocksmith	728,667
Stove automatic cut-off, gas, F. C. Miller	728,267
Stove, heating, J. H. Waters	728,527
Stovepipe for flue cleaning, H. M. Shields	728,508
Stump extractor, O. J. Dahl	728,551
Stump puller, portable, T. A. Kundson	728,248
Sugar constituents, extracting, L. Naudet	728,600
Surgical instrument, L. Levi	728,589
Surveying instrument illuminator, C. M. Bernegan	728,357
Suspenders, H. C. Hine	728,712
Tachometer, W. P. Wiemann	728,529
Tack extractor, W. H. Brown	728,668
Talking machine sound box, E. D. Gleason	728,704
Tandem engine, compound, J. Hardill	728,708
Tank cleaning mechanism, W. B. Hogg	728,714
Telegraph, facsimile, Liebreich & Francis	728,254
Telegraphy, wireless, J. F. King	728,243
Telephone lock, E. G. Lewis	728,478
Telephone pay station coin collector, C. E. Scribner	728,309
Telephone receiver, G. E. Wheeler	728,342
Telephone system, E. Umdenstock	728,785
Telephone transmitter, G. E. Wheeler	728,344
Telephone wire hanger, Neslage & Watson	728,278
Telephony, R. H. Yurgae	728,350
Tile, floor, A. Plant	728,290
Tire, resilient, L. C. Cummings	728,678
Tire tightener, J. B. Smith	728,776
Toe weight, W. E. Sell	728,506
Tongue supporter, vehicle, W. J. Calkins	728,363
Tool, magazine, J. M. Barstad	728,188
Toy, parachute, S. S. Lawrence	728,251
Toy vehicle, H. N. Parker	728,286
Trace fastener, J. E. Henderson	728,229
Trace fastener, J. Morrison	728,744
Trace holder, J. N. Metzger	728,489
Tracks, means for operating the points on tramway or like, S. Zylberlast	728,822
Traction system, E. L. K. F. Kahlenberg	728,581
Transformer, Hill & Brown	728,575
Tree leg stretcher or holder attachment, P. J. McGrath	728,750
Trolley, G. E. Smith	728,313
Truck, car, J. A. Brill	728,792
Truck, railway car, H. R. Keithley	728,582, 728,583
Tube. See Mailing tube.	
Tube handling apparatus, T. J. Bray, Jr.	728,666
Tunnel ventilating apparatus, railway, C. F. Diether	728,685
Type carrier and selecting mechanism, H. Hill	728,711
Type writer, C. Wasmuth	728,340
Type writer, copy holder, R. J. Wood	728,646
Typewriting machine, A. de Cayron	728,671
Typewriting machine, copy holder, E. C. Price	728,613
Umbrella, J. A. Hollenberger	728,715
Upholstery spring, W. K. Parker	728,496
Vaccination or other tumors, shield for, E. S. Oliver	728,493
Valve, A. S. Tuttle	728,336
Valve, adjustable rotary, J. Pearce	728,808
Valve, air, G. Schneider	728,810
Valve, filling, A. Schneider	728,307
Valve gear, steam engines, R. L. Campbell	728,364
Valve, oscillating, G. L. Wackerow	728,787
Valves, glass seats for ball, L. W. Eggleston	728,380
Vault, burial, B. F. Van Camp	728,337
Vehicle brake, J. T. Hovis	728,394
Vehicle heating system, motor, Worth & Donaldson	728,430
Vehicle, land and water, A. Piller	728,758
Vehicle, lever, J. Scott	728,811
Vehicle, motor, J. C. Reuter	728,499
Vehicle running gear, J. S. Layton	728,252
Vehicle wheel, H. M. O'Malley	728,494
Vehicles, collector for use on electrically propelled or lighted, B. H. Bedell	728,659
Vehicles, differential gear for motor, M. G. De Simone	728,420
Vending apparatus, J. J. Reed	728,412
Vending machine, W. W. Rosenfield	728,619
Vending machine, E. Shaw	728,774
Ventilator, Foos & Muir	728,387
Voting machine, A. A. Farwell	728,218
Wagon, dumping, Currie & Conn	728,207
Wagon, dumping, J. T. Droste	728,687
Wagon, dumping, E. A. Godfrey	728,705
Wagon gear, short turn, T. Sandstrom	728,809
Wagon, lumber, O. C. Nickerson	728,406

(*Continued on page 421.*)

© 1903 SCIENTIFIC AMERICAN, INC.

WILLIAMS' SHAVING STICK

Commends itself to travelers by land or sea, on account of its convenience, compactness, luxury and economy.

25c. of all druggists.

THE J. B. WILLIAMS CO., Glastonbury, Conn.

ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book.
"CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute indorsed by Thos. A. Edison and others.
ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 W. 23d St. New York.

LEARN PROOFREADING.

If you possess a fair education, why not utilize it at a genteel and uncrowded profession paying $15 to $35 weekly? Situations always obtainable. We are the original instructors by mail.
HOME CORRESPONDENCE SCHOOL, Philadelphia

Send For It To-Day

You'll find it always convenient to have as a useful and instructive book
Montgomery & Co.'s Tool Catalogue
The new edition has 704 pages and is copiously illustrated. Pocket size 6¼x4⅛ ins. Sent by mail for 25c.
MONTGOMERY & CO., 105 Fulton St., New York City.

Astronomical AND Engineering Instruments

MANUFACTURED BY W. & D. MOGEY, Bayonne City, N. J.
Send for Catalogue.

The Solar System

By PERCIVAL LOWELL

PROFESSOR OF ASTRONOMY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.
DIRECTOR LOWELL OBSERVATORY, FLAGSTAFF, ARIZONA.

Author of "Mars," etc.

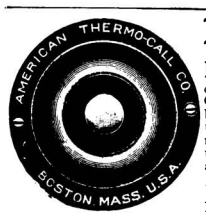
$1.25 *net* *Postage* 8 *cents*

In this volume are published six popular lectures delivered at the Massachusetts Institute of Technology. The chapters treat of our Solar System, Mercury. Mars, Saturn and its System, Jupiter and his Comets, and Cosmogony. They are illustrated by numerous diagrams and tables, and marginal notes in red.

HOUGHTON, MIFFLIN & CO.
Publishers
BOSTON and NEW YORK

PRICES REDUCED FOR 60 DAYS.

$4.00 Vapor Bath Cabinet $2.25 each
$5.00 Quaker " " 3.50 each
$10.00 " " " 6.10 each
$1.00 Face & Head Steam. Attch. 65c
Quality best. Guaranteed. $2. Book Free with all "Quakers." Write for our New Catalogue, special 60-Day offer. Don't miss it. Your last chance. New plan, new prices to agents, salesmen, managers. Wonderful sellers. Hustlers getting rich. Plenty territory.
World M'f'g Co., 97 World Bldg., Cincinnati, O.



THE AMERICAN THERMO-CALL BUTTON

discovers and reports fire automatically. Can be attached to the existing wires in hotels and manufacturing plants. Invaluable as a life and property saver in residences. No possible chance for fire to secure headway without sounding alarm. Permanent, not fusible.
American Thermo-Call Co., Boston, Mass.
Mfrs. of thermostatic devices of all kinds

Wagon rack, convertible, I. W. Snow	728,316
Wall, provisional or permanent, J. Kulhanek	728,472
Wardrobe, J. O. Clay	728,673
Washer. See Nut locking washer.	
Washing machine, O. H. Larson	728,587
Watch safeguard, H. M. Willis	728,816
Water arch, I. M. Riles	728,762
Water closet, F. Schun	728,624
Water closet flushing apparatus, A. Kulhanek	728,470
Water heater and condenser, combined, Tate & Cable	728,782
Water level indicator, F. E. Stanley	728,512
Water wheel bucket, G. J. Henry, Jr	728,230
Waterway, pleasure, H. Roltair	728,303
Weaner, cow or calf, M. S. Quiggle	728,291
Weather strip, A. J. Kitson	728,244
Weather strip, Donden & Robb	728,686
Web roll shaft, F. Meisel	728,486
Weed exterminator, B. Smith	728,312
Weighing machine, L. Hachenberg	728,569
Weighing machine, coin operated, J. Morgenthan	728,275
Welt cutting machine, W. B. Arnold	728,532
Wind motor governor, F. W. Hedgeland	728,462
Windmill, W. F. Kerr	728,468
Windmill, G. S. Lowell	728,481
Windmill regulator, G. E. Steenrod	728,513
Window strip, revolving, H. E. Essig	728,690
Window ventilator, T. T. Doll	728,447
Wire forming machine, A. C. Campbell	728,201
Wire rope fastening device, M. am Ende	728,689
Wire strainer, J. Brown	728,198
Wire stringing apparatus, E. E. Salisbury	728,768
Wire tightener, G. Robinson	728,764
Woven fabrics, apparatus for preventing production of reed stripes in, N. & J. Chaize	728,366
Wrench, J. J. Quinlan	728,410
Wrench, C. F. Doebler	728,554

DESIGNS.

Cup, R. L. Johnson	36,330
Dish, covered, R. L. Johnson	36,331
Hat holder standard, N. Simmer	36,333
Lamp, gas, A. H. Humphrey	36,332

TRADE MARKS.

Antiseptic and antimoth fabrics, J. S. Bernheimer & Bro	40,403
Battery cells, American Hard Rubber Co.	40,406
Beverages, certain named carbonated, Gruel & Otto	40,394
Butter, E. J. McBride	40,386
Candy, P. J. Alexander	40,382
Canned fruits and vegetables, H. C. Baxter & Bro	40,390
Canned fruits and vegetables, J. C. Ainsley Packing Co. 40,391,	40,392
Canned goods, certain named, Acker, Merrall & Condit Co	40,388
Cement, portland, Sandusky Portland Cement Co	40,412
Cleansing enamel surfaces, compound for, W. W. Sykes	40,407
Coats, vests, pants, and overcoats, L. Greif & Bro	40,376
Corsets, Royal Worcester Corset Co	40,379
Foods, cereal breakfast, Genesee Pure Food Co	40,384
Fruits, preserved, Acker, Merrall & Condit Co.	40,389
Garment supporters, Wheeler & Baldwin	40,378
Gas generators, acetylene, Monarch Acetylene Gas Co	40,419
Hair lotions, A. Cornioley	40,397
Hot water bags and ice bags and stoppers for same, Meinecke & Co	40,405
Incubators and brooders, J. W. Miller Co	40,420
Jelly, Genesee Pure Food Co	40,383
Liniment, King-K Medicine Company	40,404
Listing and adding machines, combined, Felt & Tarrant Manufacturing Co	40,417
Lubricants, R. N. Nason & Co	40,411
Margarin, China Export, Import and Bank Compagnie	40,385
Medicinal preparation in tablet form, Dr. Parker Med. Co	40,398
Medicine for treatment of certain named diseases of horses, Bradbury Equalizer Co.	40,402
Packing, machinery, C. A. Daniel	40,416
Paint and varnish remover, H. K. Sidle	40,410
Paints, prepared and mixed liquid, Jewell & Vinson	40,409
Practice apparatus, certain named, Sub Target Gun Co	40,415
Publication, serial, Francis Brothers	40,375
Remedies for certain named diseases, Rio Chemical Co	40,400
Remedies for indigestion, W. B. Nichols	40,399
Remedy for piles, D. Weeks & Co	40,401
Ribbons, satin back velvet, Abegg & Rusch	40,380
Roofing materials, C. B. Jameson	40,413
Salt, table, Ohio Salt Co	40,387
Savings boxes, metal, Edmonds-Metzel Manufacturing Co	40,414
Shirts, J. M. Robinson, Norton & Co	40,377
Spool cotton, A. King & Co	40,381
Syrup and carbonated beverage made therefrom, certain named, G. S. Preston	40,395
Tea, Compressed (Whole Leaf) Tea Syndicate	40,393
Tobacco, smoking, British-American Tobacco Co.	40,396
Washing machines, Capt. M. C. Randleman & Sons	40,418
Washing solution, clothes, J. E. Craig	40,408

LABELS.

"Auritone D. & D.," for medicine, Dinet & Delfosse	10,013
"Flashing Beauty," for canned fish, Acker Merrall & Condit Co	10,020
"For Your Liver's Sake Podophylets Take," for medicine, M. C. Stephens	10,012
"Gibson Musical String Co.'s Columbia Brand Steel Strings," for musical strings, Gibson Musical String Co	10,005
"Gilberts Self Packing Gauge Glass Preserver," for gage glass preservers, R. F. Morse	10,006
"Harrington's Strictly Pure Extracts, Essences and Preparations," for extracts, essences and preparations, Schlotterbeck & Foss Co	10,017
"Labor's Choice Whiskey," for whisky, Hamburger Company	10,016
"Lightning Tapioca," for tapioca, W. S. Hurd	10,019
"Lilley's Pick Me Up, P. M. U," for medicine, R. M. Lilley, Sr., and R. M. Lilley, Jr.	10,014
"McNamee's Sanitary Mesh-Knit Underwear," for underwear, J. McNamee	10,007
"'Nojar' Rubber Heels," for rubber heels, F. W. Whitcher	10,009
"Ryena," for food product, Battle Creek Ryena Food Co	10,018
"Star," for snuff, C. J. Bachmann	10,015
"Sunshine Metal Polish," for metal polish, Sunshine Polish Co	10,021
"Velvet Rubber Heels," for rubber heels, F. W. Whitcher	10,010
"Velvet skin cream," for cosmetic, A. F. Wood	10,011
"Velvet Whole Heels," for rubber heels, F. W. Whitcher	10,008

PRINTS.

"See The Bottle," for ginger ale, Gosman Ginger Ale Co	704
"The High Grade Mirror Candies," for candy, Gray Lithograph Co	703

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

THE HARRINGTON AND KING PERFORATING CO.

PERFORATED METALS
OF EVERY DESCRIPTION AND FOR ALL PURPOSES
FOR SCREENS OF ALL KINDS.

No 225 NORTH UNION ST CHICAGO, ILL. U.S.A.

"The Heart of the Continent."

11,126 MILES

of railway east of Chicago, St. Louis and the Mississippi River, with eastern terminals at New York, Boston and Montreal, are embraced in the

NEW YORK CENTRAL LINES

For No. 3 of the Four-Track Series, containing a map showing this Central Railway System of America, send a two-cent stamp to George H. Daniels, General Passenger Agent, New York Central R. R., Grand Central Station, New York.

"KEEP COOL"

HOW? WITH HOT AIR
GREAT POWER LEAST EXPENSE
Send for catalog of our new CALORIC FAN ENGINES $8.
MOST POWERFUL WHITE LIGHT
SUN RIVAL
Magic Lanterns, Picture Machines, Films and Slides. Bought and Sold.
HARBACH & CO. 809 Filbert Street, PHILADELPHIA, PA.

% "CENT per CENT"

A Monthly Magazine for Investors—presenting facts, figures and information in an interesting manner—50 cents a year. Three months' trial subscription 10 Cents, stamps or silver. Sample copy free.
Mitchell, Schiller & Barnes, 52 B'way, New York.

DRINK PURE WATER

if you want to be healthy. Don't venture on drinking doubtful water. Always use the

Berkefeld Filter

which completely removes typhoid and cholera germs from the water. Send for circulars.
BERKEFELD FILTER CO., 4 Cedar Street, New York.

SPLITDORF SPARK COILS
25 VANDEWATER ST. N.Y.

I Print My Own Cards

Circulars, newspaper. Press, $5. Larger size, $18.00. Money saver. Big profits printing for others. Type setting easy, rules sent. Write for catalog, presses, type, paper, etc., to factory, The Press Co., Meriden, Conn.

AN ENGINEER'S LIBRARY.

An absolute Encyclopædia for Engineers or for Steam Users, Electricians, Firemen and Machinists, is the
HANDBOOK ON ENGINEERING.
By HENRY C. TULLEY.
Third edition, enlarged and revised, 5,000 copies, now ready. Sent anywhere on receipt of price, $3.50—money back if dissatisfied. 900 pages. 400 fine illustrations. Thoroughly reliable and practical. Handsomely bound in leather and gilt. Pocket-book form.
H. C. TULLEY & CO., 1060 Wainwright Bldg., St. Louis, Mo., U. S. A.

A GOOD INVESTMENT

For $1.75 we will send by express (not prepaid), complete N. D. Outfit with full instructions for learning TELEGRAPH OPERATING.

A fascinating study that will enable you to earn good wages. Send 25 cents for universal dating stamp, by mail, postpaid. Send for our catalog. *Established* 1879.
J. H. BUNNELL & Co., Inc. 20 Park Place New York

YOU ARE EASY

If you need a carpenter to help you repair your roof with
Warren's Natural Asphalt Sand Surfaced Roofing

The best and most serviceable prepared roofing on the market. It is durable, fire-proof, and does not require painting.
Comes ready to lay in rolls containing 108 sq. ft.
Warren Chemical & Mfg. Co., 18 Battery Pl., New York

PROPOSALS.

SEALED PROPOSALS WILL BE RECEIVED AT the office of the Light-House Engineer, Tompkinsville, N. Y., until one o'clock P. M., Wednesday, June 24th, 1903, and then opened, for furnishing and delivering miscellaneous articles required for the use of the Light-House Establishment during the fiscal year to end June 30, 1904, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to
MAJOR WILLIAM T. ROSSELL, U. S. A., Engineer Third Light-House District.

Mathematicians Wanted

The profession of actuaryship offers a splendid field for those possessing mathematical ability, as positions command $4,000 a year and over. Our course is prepared by leading actuaries and is under their supervision.
Address
HOME CORRESPONDENCE SCHOOL
416 Walnut St., Philadelphia, Pa.

"THIS BEATS NEW JERSEY."

Charters procured under South Dakota laws for a few dollars. Write for Corporation laws, blanks, by-laws and forms to PHILIP LAWRENCE, late Ass't Sec. of State, Huron, S. Dak. or Room K, 20th floor, 220 B'way, N. Y.

FREE Catalogue of Architectural, Scientific and Technical Books. Prospectus for 1903 for "Architects' and Builders' Magazine," monthly $2 a year.
WM. T. COMSTOCK, Pub., 23 Warren St., New York.

SPECIAL MANUFACTURING, SPEC. MACHINERY, MODELS, EXPERIMENTAL WORK, DIES AND STAMPING. PROMPT. GLOBE MACH. & STAMPING CO. 970 HAMILTON ST CLEVELAND, O.

? "Mental Nuts."—Can you crack 'em?
"1400 Conundrums and Riddles."
"Knots."—100 catch problems.
"Puzzle Book."—Can you do 'em?
Puzzle Books. 10c. each, all 4 for 30c.
Home Supply Co., D. 15, 132 Nassau St., New York.

STEEL TYPEWRITER TYPE
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

Are you interested in Patents, Model or Experimental work? Our booklet entitled
WHAT WE DO—HOW WE DO IT
will be sent to you on request.
KNICKERBOCKER MACHINE WORKS, Inc., 8-10-12 Jones Street, New York.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee Wis.

Model Machinery and Experimental Work.
W. H. CRAWFORD, 194 Broadway, New York City.

MODELS & EXPERIMENTAL WORK.
Inventions developed. Special Machinery.
E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

MODELS & GEARS CATALOGUES FREE UNION MODEL WORKS 193 CLARK CHICAGO.

INVENTIONS DEVELOPED.
WALTER K. FREEMAN, M.E.
Special machinery, electrical and chemical apparatus made on short notice. Good accommodations for inventors. 403 E. 23d St., New York.

TELEGRAPHY Circular free. Wonderful automatic teacher. 5 styles. $2 up.
Omnigraph Co., 52, 39 Cortlandt St., New York

MATCH MACHINERY.
BIG MONEY IN MATCHES.
We manufacture everything pertaining to the business. The Very Latest Process. We will furnish a manager or teach any purchaser the business.
F. W. MURPHY & BRO., 1118 Ashland Block, Chicago, Ill., U. S. A.

NAME PLATES—EMPLOYEE CHECKS
KEY TAGS, BAGGAGE C'KS & BADGES
J. ROBBINS MFG. CO. 58 KNEELAND ST.
SEND FOR CATALOGUE BOSTON, MASS.

$2.50

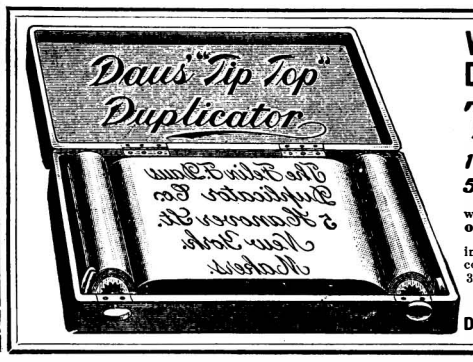
AEOLICRAFT Model Yacht

Sails on a tight wire; goes about automatically at each end; keeps in motion as long as the wind blows.
The Latest Scientific Toy.
Fascinating to old and young. Beautifully made.
Single, $2.50; Pair, for racing, $4.50, prepaid.
Send for descriptive booklet No. 9, free.
FRANKLIN MODEL SHOP, 198 W. 31st Street, New York City.

THE STEAM TURBINE; THE STEAM Engine of Maximum Simplicity and of Highest Thermal Efficiency. By Prof. R. H. Thurston. A valuable series of articles having cuts of some of the more efficient engines of this type—the Parsons', DeLaval, Dow, etc.; with exhaustive tables giving the result of tests and much general data on the subject. Contained in SUPPLEMENT Nos. 1306, 1307 and 1308. Price 10 cents each. For sale by Munn & Co. and all newsdealers

...Upright Drills...

Complete line, ranging from our New Friction Disk Drill for light work to 42-inch Back Geared, Self Feed Drill. Send for Catalogue and Prices.
W. F. & JOHN BARNES CO.
(*Established* 1872)
1999 Ruby St., - Rockford, Ill.



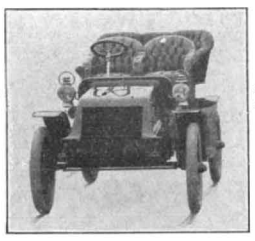
What is DAUS' "TIP-TOP"?

TO PROVE that Daus' "Tip-Top" Duplicator is the best, simplest, and cheapest device for making

100 copies from Pen-written and 50 copies from Typewritten original

we are willing to send a complete "Duplicator" **without deposit on 10 days' trial.**
No mechanism to get out of order, no washing, no press, no printer's ink. The product of 23 years' experience in Duplicators. Price for complete apparatus, size No. 1. $7.50, subject to the trade discount of 33⅓ per cent., **or $5.00 net.**
FELIX F. DAUS DUPLICATOR CO., Daus Building, 113 John St., New York

© 1903 SCIENTIFIC AMERICAN, INC.



The **Winton**

"Governor-Button"

Do you know what it is? It is a little spring button the size of a nickel, placed where it comes under the right foot of the driver, and this little button controls the speed of this splendid touring car. Such is WINTON simplicity. Write for catalogue.

THE WINTON MOTOR CARRIAGE CO., Cleveland, O.

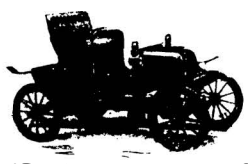
A SUCCESS

The New FISK Detachable

Write

FISK RUBBER COMPANY
Chicopee Falls, Mass.

CRESTMOBILE $750



The most logically constructed car made.

Write for cat.

Other models at **$500** and **$550.**

CREST MFG. CO., Cambridge, Mass., U.S.A.

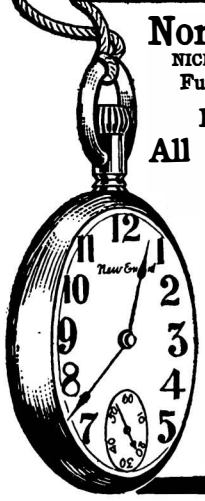
Squabs Pay Beat Hens

Easier, need attention only part of time, bring big prices. Raised in one month. Attractive for poultrymen, farmers, women. Send for **FREE BOOKLET** and learn this *immensely rich home industry.*

Plymouth Rock Squab Co., 14 Friend St., Boston, Mass.

$200 Padishah

The Best Low Priced Jeweled Watch Made



Non-Magnetic
NICKEL SILVER CASE
Fully Guaranteed

For sale by
All JEWELERS

Illustrated Booklet on request, showing
COLORED FANCY DIALS

The New England Watch Co.

Factories
Waterbury, Conn.

Offices
New York, Chicago, San Francisco.

BRISTOL'S RECORDING INSTRUMENTS.

Pressure Gauges, Vacuum Gauges, Voltmeters, Amperemeters, Wattmeters, and Thermometers, make continuous records *Day and Night.* Will pay for themselves. Every instrument fully guaranteed and sent on 30 days' trial. ☞ *Send for Circulars and Specimen Chart.*

The Bristol Company, Waterbury Conn.

SILVER MEDAL PARIS EXPOSITION.

CHARTER ENGINE

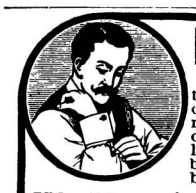
USED ANY PLACE BY ANY ONE FOR ANY PURPOSE

Stationaries, Portables, Sawing Outfits, Hoisters, Engines and Pumps.

FUEL—Gasoline, Gas, Distillate.

Send for Illustrated Catalogue and Testimonials, and State Your Power Needs.

CHARTER GAS ENGINE CO., Box 148 STERLING, ILL



Beauty and Utility

Every business man knows the annoyance of loose shirt cuffs. Every wise business man ought to know that they can be easily fixed and regulated to any desired length below the coat sleeve by using

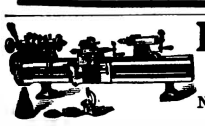
Washburne's Cuff Holders

They can be instantly attached or detached. They never come loose—have a grip like a bulldog.

Illustrated catalogue on request.

Sample pair of Cuff Holders sent by mail on receipt of **20c.**

AMERICAN RING CO.,
Box 8. Waterbury, Conn.



RIVETT LATHE

No up-to-date manufacturer can afford to do without it.

HIGHEST AWARD wherever exhibited.
☞ Send for Catalog.

Fanouil Watch Tool Company,
BRIGHTON, **BOSTON, MASS., U. S. A.**

TO THE BALTIC SEA

LAND OF THE MIDNIGHT SUN

NORWAY. SWEDEN. RUSSIA & DENMARK

These delightful and health-giving cruises, upon the palatial twin-screw steamship PRINZESSIN VICTORIA LUISE are unsurpassed.

1. A cruise of 22 days to Hamburg and return. Rates $200 and upward. To **Norway,** the **North Cape** and **Spitzbergen** by Twin-Screw Cruising Steamer PRINZESSIN VICTORIA LUISE, leaving Hamburg, July 28, 1903. This is an ideal Summer trip. You escape the heat and cruise around in cool latitudes.

2. A cruise of 23 days from Hamburg and return. Rates $200 and upward. To **Norway, Sweden, Russia** and **Denmark,** by the Twin-Screw Cruising Steamer PRINZESSIN VICTORIA LUISE, leaving Hamburg August 23, 1903. A trip full of historic and scenic interest for the tourist at the most delightful season of the year. **Stops made at all important points during voyage.**

For dates of departure to and from New York by the Hamburg-American Line's Twin-Screw Express and Passenger Steamers, in connection with above cruises, see regular Transatlantic Sailing List. Through rates quoted on demand. Special pamphlets, containing full descriptions of the above trips, will be sent upon application to the

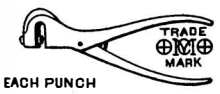
HAMBURG-AMERICAN LINE

35-37 Broadway, New York; 1229 Walnut Street, Philadelphia; 159 Randolph Street, Chicago; 70 State Street, Boston; 106 North Broadway, St. Louis; 401 California Street, San Francisco; 116 Euclid Avenue, Cleveland, Ohio

---

MORRILL'S "HERCULES" PUNCH

WILL PUNCH A ¼ INCH HOLE THRO 18 GAUGE SHEET IRON
SIMPLE IN OPERATION
INEXPENSIVE
DURABLE
INTERCHANGEABLE
CONVENIENT
THREE SIZES OF DIES WITH EACH PUNCH



WRITE FOR FURTHER INFORMATION TO
CHAS. MORRILL, 271 BROADWAY, NEW YORK.

ELECTRICAL TESTING

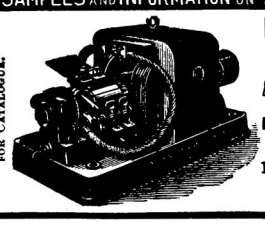
If you wish to know the properties of any electrical instruments, materials or apparatus, the utility of an invention or the practicability of an idea, tests by us might be of great value to you.

NEW YORK LABORATORY, LAMP TESTING BUREAU
8th Floor. No. 14 Jay Street, New York

COLD GALVANIZING

AMERICAN PROCESS NO ROYALTIES
SAMPLES AND INFORMATION ON APPLICATION.

SEND YOUR BUSINESS CARD FOR CATALOGUE.



NICKEL AND **Electro-Plating**
Apparatus and Material.
THE
Hanson & Van Winkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St. Chicago.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill

---

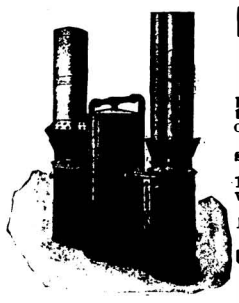
MICROSCOPES

for every purpose. Our instruments are found in all the best laboratories of the country. Catalog free.

Projection Apparatus

for scientific work. Superior in accuracy and convenience.

Bausch & Lomb Optical Co.,
Rochester, N. Y.
NEW YORK BOSTON CHICAGO



PALATABLE WATER-STILL

Produces an absolutely **pure** and **aerated water** for **manufacturing** or **drinking** purposes.

Attachable to **any steam boiler.**

Made in all sizes, from 10 to 200 gallons distilled water per hour.

In use in U. S. Army and Hospital Marine service.

Write for catalogue.

PALATABLE WATER-STILL COMPANY.
Boston, Mass., U. S. A.

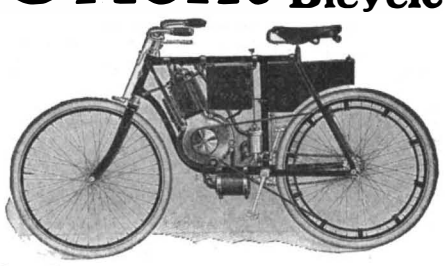
"The most satisfactory cement Mill made."

THE GRIFFIN MILL

THE GRIFFIN MILLS which we have sold for this purpose will produce 50,000 barrels of Portland cement a day, or over 15,000,000 barrels a year. No other mill approaches such a record, because no other mills begin to work as cheaply or as satisfactorily. Write for our illustrated descriptive catalogue.

BRADLEY PULVERIZER CO. BOSTON, NEW YORK, CHICAGO.

Orient Motor Bicycle



3 H. P. Speed over **40** Miles per hour. Price **$250.** The Most Powerful Motor Bicycle in the World.

Write for Catalogue.

WALTHAM MFG. CO., Waltham, Mass.

PALMER

MARINE and STATIONARY
MOTORS
2 and 4 CYCLE

are no experiment, as they are in successful operation in all parts of the world.

Launches in stock.

Send for Catalogue.

PALMER BROS.,
Cos Cob, Conn.
New York Office, 136 Liberty St.

POTTER'S "SPRING" BRAKE BLOCKS. Adapts the whole length of shoe to wheel under all circumstances. Does not squeak, rattle, jump, or freeze up. Will hold rubber wear shoes without bolts or screws. Special Concave Shoes for Rubber Tire. **Morgan Potter,** Fishkill-on-Hudson, N. Y., U. S. A.

The Typewriter Exchange

1½ Barclay St., NEW YORK
124 La Salle St., CHICAGO
38 Bromfield St., BOSTON
817 Wyandotte St., KANSAS CITY, MO.
209 North 9th St., ST. LOUIS, MO.
536 California St., SAN FRANCISCO, CAL.

We will save you from 10 to 50% on Typewriters of all makes. *Send for Catalogue*

JESSOP STEEL CO.
MFRS OF CRUCIBLE SHEET STEEL
WASHINGTON, PA.

WELL DRILLING Machines

Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engines or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.

WILLIAMS BROS., Ithaca, N. Y.

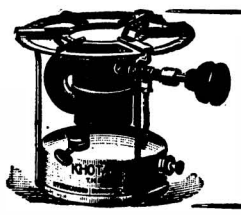
The Cheapest Belting

No other belting is so cheap to buy for actual use as "Royal Worcester. Positively gives the best service. Pure oak tannage; uniform strength; weighs the most; therefore greatest belt power transmitter in existence to-day. Saves loss of power, time, labor, machinery; prevents accidents.

You can test it free on your own machinery—if you say so.

Let us quote you price, and give you some belting facts.

GRATON & KNIGHT MFG. CO.
Oak Leather Belt Makers, Worcester, Mass.



Kerosene Blue Flame Oil Stove

Makes its own gas. No odor, no smoke, no danger, **no wicks.** Best in the world for cooking. Gives twice the heat at less than half the cost of gas.

PRICE $3.75, and upwards. Send for Catalogue.

The **KHOTAL BURNER CO., 197 Fulton Street, New York**

PARALLEL CH-BESLY & Co CLAMPS ALL ANGLES SIDES = U.S.A.
15 to 21 Clinton Street.

© 1903 SCIENTIFIC AMERICAN, INC.